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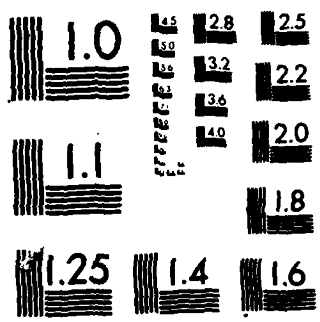

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This report is a fully annotated bibliography of references on dredging operations, equipment, and processes. Dredged material disposal and environmental aspects of dredging are not included. Bibliographic listings with annotations are arranged alphabetically by author, with separate section for anonymously authored articles. Keyword index at end lists references by title and reference number. Report is furnished in loose leaf form with binder and is issued in several installments, each with cumulative keyword index.

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PREFACE

This bibliography was begun under the Improvement of Operations and Maintenance Techniques (IOMT) research program, sponsored by the Office, Chief of Engineers (OCE). It is being continued, using funds provided by the Water Resources Support Center Dredging Division and the Operations Division, Civil Works Office.

Installments 1 and 2 of this bibliography were prepared in the Hydraulics Laboratory of the U. S. Army Engineer Waterways Experiment Station (WES) under the general supervision of Messrs. H. B. Simmons, Chief of the Hydraulics Laboratory; F. A. Herrmann, Jr., Assistant Chief of the Hydraulics Laboratory; R. A. Sager, Chief of the Estuaries Division; and E. C. McNair, Jr., Chief of the Sedimentation Branch. Mr. T. W. Richardson of the Research Group was the project engineer, and Mr. E. W. Flowers supervised the acquisition and compilation of bibliographic material. Recognition is made of the following persons who worked at different times on the bibliography: Ms. P. C. Habeeb, Ms. A. Y. Williams, Mr. J. J. Duffy, Mr. M. P. Alexander, and Mr. S. D. Kiger. Mr. G. R. Clark and Mrs. C. J. Coleman are also recognized for their editing and keywording contributions.

Commanders and Directors of WES during the preparation and publication of this bibliography were COL Nelson P. Conover, CE, and COL Tilford C. Creel, CE. Technical Director was Mr. F. R. Brown.

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CONTENTS

GLOSSARY

The following abbreviations are used in the reference listings of this bibliography:

Abbreviation	Complete Name
AICE	American Institute of Chemical Engineers
AIME	American Institute of Mining, Metallurigical, and Petroleum Engineers
ASCE	American Society of Civil Engineers
ASLE	American Society of Lubrication Engineers
ASME	American Society of Mechanical Engineers
BHRA	British Hydromechanics Research Association
DM	Dusseldorfer Messegesellschaft mbH
EPA	Environmental Protection Agency
IADC	International Association of Dredging Companies
IAHR	International Association for Hydraulic Research

Abbreviation	Complete Name
IEEE	Institute of Electrical and Electronics Engineers
KVI	Koninklijke Vlaamse Ingenieursvereniging
MTS	Marine Technology Society
PIANC	Permanent International Association of Navigation Congresses
SAE	Society of Automotive Engineers
SUT	Society for Underwater Technology
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USDA	United States Department of Agriculture

DREDGING: AN ANNOTATED BIBLIOGRAPHY ON OPERATIONS, EQUIPMENT, AND PROCESSES

PART I: INTRODUCTION

1. The objective of the New Dredging Concepts project is to develop procedures and techniques for applying recently developed dredging equipment to estuarine, riverine, and reservoir shoaling problems. A compilation of dredging literature in certain technical areas was needed to support this objective and serve as a data base for other equipment-related research. This bibliography is a direct result of that compilation.

2. The bibliography covers portions of the broad field of dredging. Included are publications dealing with: (a) excavation and transportation of dredged material; (b) equipment, both primary and ancillary, used to perform or enhance these functions, (c) physical processes involved in performing them; and (d) planning and execution of dredging projects. Excluded from the bibliography are publications which cover primarily dredged material disposal or environmental aspects of dredging.

PART II: USE OF THE BIBLIOGRAPHY

Organization

3. The main body of the bibliography contains reference information issued at different times in a series of installments. Each installment presents reference listings together with their annotations, arranged alphabetically by author. References without authors are located in a separate section.

4. Each listing is assigned a unique reference number. References with authors are identified by a four-digit number; those without authors are assigned a four-digit number preceded by the letter "A."

5. The bibliography index, which is updated with each new installment, is organized by keywords. A list of keywords used is presented at the beginning of the index as an organization chart. Listed in the index under each keyword are publication titles and their reference numbers. Many references are found under more than one keyword.

Explanation of Index

6. The most important part of a useful bibliography is the index. The indexing system must be detailed enough to provide meaningful distinctions. However, a complex indexing system may be difficult to use and is often unnecessary. The keyword system used in this bibliography was constructed by grouping the general areas covered into an organization chart. Moving down in the chart, each successive level gives a more detailed breakdown of the previous one. Therefore, the key to interpreting a particular keyword is to trace the path down through the organization chart leading to it. For example, the keyword "effects" has little meaning until it is placed in the context of: OPERATIONS; Execution: effects. Then, it becomes apparent that it refers to the effects of executing dredging operations.

7. Keywords were assigned to each reference using information from the annotation. In most cases, keywords could be assigned at the

lowest level of the organization chart. However, if the publication appeared general in nature or covered a broad range of topics, the keywords used were at higher levels. Thus, the keywords provide some information on the focus of a publication in a particular area.

8. Even the best keyword system must be applied by individuals, which means that subjectivity exists in assigning keywords. This is one reason why the index contains reference titles in addition to numbers. By scanning titles listed under a particular keyword, the bibliography user can quickly tell whether his interpretation of the keyword coincides with that of the bibliography authors'. Another reason for including titles in the index is so the user can eliminate references in which he is not interested or select particular ones prior to locating them in the main body of the bibliography.

PART III: REFERENCE LISTINGS AND ANNOTATIONS

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INSTALLMENT 1

Reference Numbers 0001 - 0498

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A

0001 ADAMS, A. T. H. and BUNTING, H. R. 1973. "Recent Developments in the Application of Automatic Control to Bucket Wheel Dredgers," Proceedings, Second Symposium on Automatic Control in Mining, Mineral, and Metallurgical Processing, Institution of Engineers, Australia, pp 125-130.

Paper describes recent development of control system for regulating slew drive of 1770 ton bucket wheel dredger as a means of increasing productivity in an open cut. Reference is made to operation method, controlled field tests to study certain dredger parameters and automatic control methods. A section deals with a geometric control system developed and installed by an electrical contractor.

0002 AGAR, M. and MCDOWELL, D. M. 1971 (Jun). "The Sea Approaches to the Port of Liverpool," Proceedings, Institution of Civil Engineers, Vol 49, pp 145-156.

Hydraulic investigations demonstrate many tidal system behavior features and show that powerful stationary dredges had a harmful effect on the regime. Introduction of trailer suction dredging has led to real economies and enabled approach channel to be deepened with no significant maintenance cost increase. Some features of dock and river berth approaches are described and port approach development economics are discussed.

0003 ALLEN, J. H., DAYAL, U. and JONES, J. M. 1975. "Development of Marine Sediment Impact Penetrometer," Proceedings, Oceanology International '75, SUT, pp 244-248.

Ocean exploration has brought increasing demands for knowledge. This is particularly true of ocean margins where exploration has given way to exploitation in many areas of the world. A large portion of this exploitation involves the sediment/water interface, and knowledge of sediment engineering properties is of paramount importance to seabed operations. Adaptation of terrestrial soil sampling techniques to the marine environment have not proven very successful. Present sampling techniques disturb soil more than its terrestrial counterpart, and the difficulties of maintaining in-situ pore water pressure generally result in a poor sample for laboratory analysis. A number of in-situ techniques have been considered and some used for ocean work. In general, however, the final tools are sophisticated, expensive and difficult to deploy. Laboratory tests of an Instrumented Impact Cone Penetrometer indicate that this could provide an adequate method for evaluating upper sediment strength properties. Paper outlines design criteria and provides construction details of present instrument. Results obtained with penetrometer are summarized.

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0004 ANDERSSON, H. 1974. "Extraction of Sediments from the Seafloor with the 'Dual-pipe-system'," Bulletin Series A, No. 35, Lund Institute of Technology, Department of Hydraulics, Lund University, Sweden.

Seafloor sand and gravel exploitation will be of great future importance in Sweden. Sea mining will probably be done under certain restrictions at suitable locations offshore. Restrictions may be such as: limitation of turbidity, mining must be carried out so neither holes nor ditches are formed. Mining may also be directed to areas far offshore, where conventional systems may be uneconomical. A new mining method, called the revolver method, uses the dual pipe principle, and has certain advantages and weaknesses compared with conventional mining systems. Advantages are that sediment transporting water recirculation is feasible and the method is not depth limited. Weaknesses are technical problems such as tightening of the sediment feeding device. The revolver method is now being model tested at the Division of Hydraulics, Institute of Technology, Lund. Project is supported by the Swedish Board for Technical Development.

0005 ANDREAE, J. F. R. 1975 (Aug). "Aggregate Mining," <u>De Ingenieur,</u> Vol 87, No. 34, pp 649-654.

In this article, the term 'aggregate mining' refers to offshore winning of sand and gravel to be used for industrial purposes. Description excludes shipping channel construction, pipeline trench construction, etc., whether excavated material is used for reclamation or not. Author discusses demand for sea-mined sand and gravel, prospecting, winning methods and delivery. Quality improvements are considered, and some typical projects are briefly described. Author concludes by suggesting possible future developments in aggregate mining.

0006 APGAR, W. J. and BASCO, D. R. 1973 (Oct). "An Experimental and Theoretical Study of the Flow Field Surrounding a Suction Pipe Inlet," Report No. TAMU-SG-74-203, CDS-172, Texas A&M University Center for Dredging Studies, College Station, Texas.

Object of study was to develop mathematical model of flow field around single suction pipe inlet near a horizontal boundary in an infinite reservoir. Basis for theoretical approach was potential flow theory, which neglects frictional and viscous effects. For simplicity, a point sink was employed. To investigate actual flow conditions, an experimental apparatus was developed to test model suction inlet. Inlet was simple cylindrical pipe placed at various heights from and at an angle to horizontal boundary. Experimental results conformed to theoretical for initial flow conditions when viscous effects were small. Viscous effects subsequently caused altered flow with zones of separation. Resulting flow development negated value of potential flow solution.

0007 ARGALL, G. O. 1977 (Apr). "Offshore Tin Dredging in Thailand by Divers, Bucket, and Suction Dredges," World Mining, Vol 3, No. 4, pp 42-45.

Cassiterite has been dredged from Tongkah harbor for 70 years. Today, there are three connected bucket line dredges operating in open sea further offshore and south of original harbor, a portion of which has been filled in. While many high grade and relatively shallow pockets have been mined with very low recovery, higher price for tin will encourage more fishing boat dredging near and around big dredges.

0008 ARGO, M. M. and DUNN, J. T. 1973. "The Dixie/Argo Electrovator-Submarine Electric Cutter Head," Proceedings, World Dredging Conference, WODCON V, pp 495-505.

Two types of dredge cutterhead motive power are identified:

1. Long shaft system where device supplying motive force is located above water line (usually an electric motor).
2. Short shaft system where device supplying motive force is located beneath water level.

Relative advantages and disadvantages of each system are discussed. Combined advantages of both systems led to development of "electrovator" - an underwater electric motor and gearbox.

0009 ARNOLD, E. L. 1975 (Jun). "The Selection and Application of Slurry Pumps," Pumps, Vol 105, pp 763-767.

Some basic facts concerning slurry pumps are examined. Author suggests when to specify slurry rated pump, which pump to use, and how to properly apply pump.

0010 ASANO, J. 1975. "Amphibious Bulldozer Construction Methods," Preprints, Third International Ocean Development Conference, pp 327-341.

Paper outlines advantages of amphibious bulldozer constructed by Komatsu, Ltd. These include ability to operate in water depths up to seven metres. This proves especially efficient where water is too shallow for ships or too deep for land equipment. Other advantages include great maneuverability, isolation from weather, and assurance of operator safety due to radio control. Also mentioned is high degree of work accuracy. Inevitable differences between amphibious unit and regular land bulldozer are detailed. Special considerations for underwater operations are described. Article covers important points for producing efficient amphibian/work barge coordination as derived from field experiments, including coordination with pump dredger, grab dredger and rock cutter. Future application of amphibious bulldozer is described.

0011 ASTON, C. 1974 (Nov). "Hopper Dredge Aids in Beach Nourishment," World Dredging and Marine Construction, Vol 10, No. 13, pp 24-27.

Article describes how hopper dredge Goethals, with direct pumpout capability, is nourishing beach at Mayport Naval Station, Florida. Goethals is one of sixteen hopper dredges owned and operated by Corps of Engineers for primary purpose of maintaining navigation channels.

0012 AUMENTO, F. and LAWRENCE, D. E. 1968. "Photographic Control of Deep-Sea Dredging," Paper No. 68-9, Canada Geological Survey.

From examination of dredge motions on sea floor, authors propose improvements to existing deep-sea dredging techniques. Special dredge, fitted with photographic equipment, was built. Dredge and observations it made are described in detail.

B

0013 BAARS, C. 1973 (Apr). "New Ideas for Alluvial Ore Recovery, Offshore and Deep Sea," World Dredging and Marine Construction, Vol 9, No. 5, pp 26-28.

Cutting wheel of new invention described has main advantage of soil cuttings not being pushed into buckets and compressed there. Because there are no buckets, design is for cutting wheel and not for bucket wheel. Cuttings are directly and continuously brought into water current generated by dredge pump. Suction mouth is arranged so that water is sucked through cutting edges only as they arrive in cutting position.

0014 BAKER, P. J. and JACOBS, B. E. A. 1976. "The Measurement of Wear in Pumps and Pipelines," Proceedings, Hydrotransport 4, BHRA, pp J1-1 - J1-16.

Pump and pipeline wear is an important factor in economic viability of slurry systems. To reduce wear rates, coating materials can be used to line these components. Usefulness of these linings depends on abrasion resistance, but at present little information is available. Paper describes how weight loss system can be used to determine mean wear rates for unlined components. For lined components the problem is more difficult since: a) wear rates may be much lower, and b) water absorption from slurry can affect weight loss measurements. Experiments designed to overcome these problems and some preliminary results are described.

0015 BANZOLI, V. and RODIGHIERO, A. 1976. "Unmanned Underwater Working Vehicle TM-102." Proceedings, Interocean '76, DM, Vol 1, pp 691-701.

TM-102 design allows easy adaptability of machine to wide range of underwater tasks, mainly of earth moving type. Prototype is specifically designed to bury pipelines laid on sea bottom at depths up to 200 m. TM-102 is self propelled tracked vehicle which travels astride pipe to be buried and is provided with twin cutter dredging plant for cutting V shaped trench beneath pipe and pumping excavated soil.

0016 BANZOLI, V. ET AL. 1976. "New Concept of Underwater Remote Controlled Tracked Vehicle for Deep Water Trenching Operations," Proceedings, Eighth Annual Offshore Technology Conference, Vol 2, pp 647-664.

Prototype of newly conceived underwater tracked vehicle for trenching operations has been constructed and tested by TECNOMARE S.p.A. Development of vehicle, designated TM-102, started in 1971 as research project and led in 1975 to prototype which has been successfully tested both in shipyard dry-dock and at sea. Vehicle is remotely controlled by surface support vessel through an umbilical cable and can solve problem

of burying cables and pipelines in water up to 200-meter depth with bottom soil of various characteristics. Vehicle moves astride pipe without exerting stress on pipe itself and can dig trenches of various shapes. Paper examines problems connected with burying pipes and cables and describes TM-102 design criteria. TM-102's main characteristics and working capabilities, together with results of shop and field tests, are presented. Possible developments of trenching system are indicated.

0017 BARAM, M. S. and LEE, W. 1974. "Coastal Resource Management in the United States: The Case of Submarine Sand and Gravel Extraction," Proceedings, World Dredging Conference, WODCON VI, pp 455-476.

Paper examines existing management systems for submerged hard minerals in several states. Ownership and jurisdictional issues are discussed, followed by a description of management programs in several northwestern U. S. states. Analysis of existing programs includes legal, economic, political and institutional viewpoints. Core of analysis consists of following questions:

(1) Do resource owners get fair share of minerals exploitation returns?
(2) Is environmental quality adequately protected?
(3) Is there effective public participation in decision-making processes?
(4) Where do potential improvements lie in current management system?

0018 BARKER, G. and MCKAY, C. 1972 (Jul). "Some New Concepts in Dredge Design," Mining Magazine, Vol 127, No. 1, pp 25, 27, 29, 31.

There is an increasing need for deeper digging and higher capacity dredges for mineral mining and marine construction inland and offshore. Hydraulic cutterhead and bucket-line ladder dredges are especially important because they are continuous digging machines with high availability. Article presents recent developments, characteristics, relative economics and applications of these two dredge types.

0019 BARKER, M. L. 1973. "A Study of Jet Pump Dredging and Pipeline Transport of Diamond Bearing Gravel," Research Report No. 1211, BHRA Fluid Engineering, U. K.

Report presents study of diamond bearing gravel hydraulic transport intended to reduce amount of manhandling. First stage of study examines possible uses of jet pump in raising gravel from pits to ground level and transporting it over long distances. Equipment layout and jet pump design are considered, as are additional solids handling pumps for extra pressure generation in pipeline to recovery plant. Computer program is developed. Second stage concerns flexibility of transporting gravel over longer distances by pipeline at solids flow rate of 20 to 50 tons/hour.

0020 BARNARD, W. D. 1976. "Predicting and Controlling Turbidity Around Dredging and Disposal Operations," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 930-935.

In maintaining and developing U. S. waterways and harbors, the Corps of Engineers annually dredges over 350,000,000 cu yd at costs approaching $200,000,000. To study the environmental impact of dredging, the $30,000,000, five year Dredged Material Research Program (DMRP) was initiated in 1973. Primary goal of program is to provide information on the environmental impact of dredging and disposal and to develop dredging and disposal alternatives, including consideration of dredged material as a manageable resource. One DMRP task area deals with prediction and control of turbidity around dredging and disposal operations. Primary objective is to investigate problem of turbidity and develop methods to predict its nature, extent, and duration. Equal emphasis is placed on evaluating both chemical and physical methods for turbidity control. Research within this task area is organized into: (i) evaluation of nature, extent, and duration of turbidity generated by dredging and disposal operations and development of predictive capability, and (ii) evaluation of methods and techniques for controlling or mitigating turbidity.

0021 BASCO, D. R. 1973. "Systems Engineering and Dredging - The Feedback Problem," Report No. 173, Texas A&M University Department of Civil Engineering, College Station, Texas.

A hydraulic cutterhead dredge which excavates soil at one point and disposes of it some distance away is an extremely complicated system. Soil, operation and other considerations vary considerably, therefore actual dredging projects must be employed to gather information. Unfortunately, information feedback from dredging projects is practically nonexistent. Paper outlines important links in dredging system chain and develops methods for overcoming obstacles to feedback. Computer model of hydraulic dredging system is developed and used to examine four major limitations on solids output: horsepower, cavitation, line plugging and dislodgement limits. Full scale feedback program is developed.

0022 __________. 1974. "Parameter Study of Variables Affecting the Performance of a Hydraulic Pipeline Dredge Model," Proceedings, Seventh Dredging Seminar, Texas A&M University Center for Dredging Studies, pp 43-78.

Author briefly reviews elements of equation-based model of hydraulic dredging system which demonstrate effects of line length, digging depth and grain size on solids output. Limited field data "agreed" with model results. Test program was devised to investigate relative influence on solids output of variables in the dredging process. One key test involved effects of five different dredge pump designs on solids output. Author has drawn the following conclusions: (i) "One dredge pump is as good as another" (hydraulically) hypothesis must be rejected. Substantial differences in production (50%±) were demonstrated for

horsepower (line-length) and cavitation (digging depth) limiting criteria. (ii) Model dredge program can systematically and economically study effects of variables such as horsepower, suction-pipe size, particle size, and others.

0023 BASCO, D. R. 1975 (Feb). "Analytical Model of Hydraulic Pipeline Dredge," Journal, Waterways, Harbors, and Coastal Engineering Division, ASCE, Vol 101, No. WW1, pp 33-48.

Paper develops and demonstrates how dredge performance can be computed using basic principles of fluid mechanics and sediment transport. Four factors which limit dredge output are examined along with development of computer-based model for dredge system computations.

0024 ________. 1975 (Aug). "Feedback From Field Studies of Hydraulic Dredges." Journal, Waterways, Harbors, and Coastal Engineering Division, ASCE, Vol 101, No. WW3, pp 277-289.

Hydraulic dredging is an extremely complicated process. Much remains to be discovered about its nature. Soil, operation, and other considerations vary considerably; therefore, actual dredging projects must be employed to gather information and overcome gaps in dredging knowledge. Methods and equipment are examined for overcoming obstacles to information feedback from real dredging situations.

0025 ________. 1975 (Jan). "Pump Designs Affect Performance," World Dredging and Marine Construction, Vol 11, No. 1, pp 10, 12.

Model of hydraulic dredging system was developed. Model is set of equations which describe system elements, such as pump head-discharge relationship and pipeline energy loss. To facilitate calculations, IBM 360/65 computer is employed.

0026 ________. 1975 (Sep). "The Relative Influence of Some Variables on the Performance of a Hydraulic Pipeline Dredge Model," Proceedings, First International Symposium on Dredging Technology, BHRA, pp C1-1 - C1-15.

Computer based model of hydraulic pipeline dredging system is employed to study relative influence of major independent variables such as pump characteristics, horsepower, sediment size, and suction pipe size. Variables are examined for effects on solids output for wide range of pumping distances and digging depths using three representative dredge sizes. Model advantage is that one parameter can be systematically varied while all others are held constant. Results demonstrated that 'one dredge pump is as good as another' hypothesis must be rejected. Substantial production differences were demonstrated for both horsepower and cavitation limitations for various pumps studied. Quantitative comparison of model solids output with field data gave encouraging results. Further field data is required to completely verify analytical methods.

0027 BASCO, D. R. and DOMINGUEZ, R. F. 1973 (May). "Cutterhead Evaluation and Improvement Program," World Dredging and Marine Construction, Vol 9, No. 6, pp 14-17.

Three phase program is outlined to study problems resulting from cutterhead dredge operation. Basic hydrodynamic conditions in vicinity of rotating cutterhead are studied.

0028 BASCO, D. R. ET AL. 1977 (Aug). "Adequacy of Dredging Methods and Equipment in the United States for Maintenance of Navigable Waters," Journal, Environmental Engineering Division, ASCE, Vol 103, No. WW3, pp 349-372.

Task Committee on Maintenance of Navigable Waters reviewed U. S. dredging fleet (both federal and private) to determine usage rate and adequacy. Information such as type of disposal, new dredging parameters, and environmental concerns are documented. Ability of dredging fleet to meet current and future requirements is evaluated. Dredging fleet is generally obsolete and not able to fill current needs for exposed water operation and beach nourishment. There are insufficient hopper and side-casting dredges, while dustpan and mechanical dredge fleet is adequate. Pipeline dredges are underutilized and in need of modernization.

0029 BASCOM, W. 1970 (Aug). "Underwater Dredge," Ocean Industry, Vol 5, No. 8, pp 16-18.

World's first submarine dredge moves through offshore sandbanks, swinging dredge ladder tipped by rotating cutterhead, sucking sand into pump which boosts it shoreward via 12-in. pipe line and spews it out on beach. Advantages over surface dredges are that it can operate effectively and safely in rough surf and can ride out sudden squalls in deep water. In severe storms, underwater dredge can climb out of sea and seek safe haven on land. Unit requires only two men aboard during operations. Two major cylindrical compartments at right angles are connected by crawl-through tube. Larger cylinder (6 ft diam) is operator's compartment. Air and electricity are supplied from shore, through trailer.

0030 BERGMAN, G. 1980. "New Motion Suppression System," Proceedings, World Dredging Conference, WODCON IX, pp 423-436.

Pitching motion of conventional floating dredges can be reduced using new pitch suppression system, with corresponding reduction of excavator (cutter head, bucket wheel, clam shell, etc.) motion relative to sea floor. If properly exploited, system reduces both vertical and horizontal motions.

Suppression system consists of two ballast water tanks open to sea, one foreward and one aft, interconnected with ducts and located below water line. Air is forced into tanks via ducts until they are half full of air. System is passive. No power is required once it has been put into operation by inflation.

0031 BIDDLE, P. and MILES, J. H. 1975 (Jan). "Use of Surface-Active Chemicals in Pump-Ashore Schemes and Suction Dredgers," Report AERE-R 6816 (Rev), U. K. Atomic Energy Authority, U. K.

Surface-active agents added to mud or silt samples accelerate dewatering and consolidation. Laboratory tests and pilot-scale trials have been carried out using Thames "black mud" combined with either a flocculating agent (polyacrylamide PAM) or a protective colloid (sodium carboxymethyl cellulose SCMC). Measurements have been made of settling rates, packing densities, rate of water loss, and increase in bearing strength. Effects of salinity, origin of mud or silt, ionic character of PAM, and concentration on settling rates have been determined. Whereas SCMC has little effect, PAM accelerates dewatering and consolidation in the early stages. For application to pump-ashore schemes consolidation needs to be studied on a large scale over a longer period. In suction dredging the benefit would be to increase spoil density in the dredger, but flocculant requirements are high and this work suggests that it is not economic. Recommendations are made for further work on pump-ashore application. No further work is envisaged on suction-dredger application.

0032 BINKLEY, J. D. 1976 (Dec). "New Method Digs Deep for Aggregates," World Dredging and Marine Construction, Vol 12, No. 13, pp 23-25.

Ohio Gravel Division of Dravo Corporation exhausted above water deposits at Ross Plant near Cincinnati. Core samples showed usable aggregates to depth of 80 ft, and it was decided to dredge the area. Selected dredger, an AMMCO Model PD 12C, is described with options used for project. Standard auxiliary engine was replaced and dredger assembled for launching at plant.

0033 BLACK, W. L. 1977 (Aug). "Adequacy of Dredging Methods and Equipment in the United States for Maintenance of Navigable Waters," Journal, Waterway, Port, Coastal & Ocean Division, ASCE, Vol 103, No. 3, pp 349-372.

The Task Committee reviewed the U. S. dredging fleet (both Federal and private) to determine usage rate and adequacy. Information such as type of disposal, new dredging parameters, and environmental concerns are documented. Ability of dredging fleet to meet current and future requirements is evaluated. Dredging fleet is generally obsolete and not able to fill current needs for exposed water operation and beach nourishment. There are insufficient hopper and sidecasting dredges, while dustpan and mechanical dredge fleet is adequate. Pipeline dredges are underutilized and in need of modernization.

0034 BRAHME, S. B. and HERBICH, J. B. 1977. "Dredging in India - Suggested Improvements in Techniques and Equipment," Engineering Report No. 204, Texas A&M University Department of Civil Engineering, College Station, Texas.

Study describes dredging problems encountered at several major Indian ports. Site conditions and corresponding environmental characteristics are discussed and related to dredging problems. Dredging equipment currently used is discussed and improvements suggested. Special attention is given to dredging problems during monsoon season since during this period 70% of siltation occurs. Major improvements in dredging operations and equipment are given.

0035 BRAY, R. N. 1975. "Practical Analysis of Dredger Capability," Proceedings, First International Symposium on Dredging Technology, BHRA, pp A3-33 - A3-48.

Paper identifies requirement for linking theoretical characteristics of dredging equipment, instruments, site conditions and operator constraints with practicalities of managing dredger or fleet of dredgers. Information sources are considered and their relevance and processing discussed. Parameters affecting overall output and efficiency are defined and source material analysis is described. Examples of parameter use to estimate practical dredger outputs are given and calculation of dredger fleet capacity is demonstrated. Consideration is given to economic problems in determining viability of dredger ownership, and factors influencing decision are discussed.

0036 __________. 1977 (Jul). "Choosing the Right Dredger for the Job," International Dredging and Port Construction, Vol 4, No. 8, pp 17, 19, 21, and 23.

Author outlines dredger selection procedure. It is necessary to obtain information on available dredgers, their dimensions, characteristics and operating costs, site operating conditions and a comprehensive job specification giving all relevant depths, distances, tolerances and environmental limitations. Author categorizes existing dredger types in terms of dimensions, soil, sea state, environmental and other factors.

0037 __________. 1978 (Dec). "Estimating Dredger Output," Dock and Harbour Authority, Vol 59, No. 697, pp 246-248.

Simplified method to establish dredge size required for particular project is described. To demonstrate estimating process, cutter suction dredge was chosen. Method is used for other dredge types in modified forms to suit each dredge's characteristics.

0038 __________. 1979. Dredging: A Handbook for Engineers, Edward Arnold Ltd., London, U. K.

Book is guide to all aspects of dredging, including choice of dredge, operating methods, machine performance, contract, costs, planning and supervision, design, and environmental effects. Simplified method is given for establishing size dredge required for particular project. Text includes illustrations. Bibliography is provided at end of each chapter. Book is intended for port engineers, consultants and contractors, working on inland waters and harbors.

0039 BREINER, S. 1976 (Mar). "Magnetometer Locates Pipelines, Iron Debris," World Dredging and Marine Construction, Vol 12, No. 4, pp 22-26, 28.

Article describes design and operation of magnetometer for detecting pipelines and iron debris submerged beneath mud and silt. This is important in channel dredging, for instance, where operator needs to locate pipelines or large iron debris capable of damaging dredging equipment.

0040 BROWN, C. and GRUNDY, C. 1973 (Jul). "Shaped Charges Blasting Technique Simplifies, Speeds Dredging Operation," World Dredging and Marine Construction, Vol 9, No. 9, pp 31-33.

Shaped charge blasting process refined by Jet Research Center, Inc., has been used to crush and fracture submerged rock and coral formations in 40 dredging projects. Process involves two-part nonexplosive chemical system. Charges are shaped to converge detonation waves in one direction.

0041 BRUHL, H. 1976. "The Effect of Fines on the Pressure Loss in the Transport of Slurries," Proceedings, Interocean '76, DM, pp 168-180.

Small amounts of fine material in pipeline slurry may cause significant changes in flow behaviour and pressure drop. In commonly used methods for head loss calculation, either homogeneous or heterogeneous suspension is assumed. Formulas cannot be applied where transport is mixed homogeneous and heterogeneous; e.g. if sand covered by silt layer is to be dredged. Data from test rigs as well as prototype show that head loss may be reduced up to 50% by addition of fines. Examples are given for decreases in critical velocity, critical pressure drop, and specific energy consumption. Head loss reduction increases with concentration of solids and fines. Pressure drop reduction by fines is more effective with fine material than with coarse one. Recommendations are given to modify most commonly used methods for head loss calculation to take into account presence of fines. Modifications are based on relative variation of particle fall velocity in fines/water suspension rather than in water as carrying fluid.

0042 BRUHL, H. and KAZANSKIJ, I. 1976. "New Results Concerning the Influence of Fine Particles on Sand-Water Flows in Pipes," Proceedings, Hydrotransport 4, BHRA, pp B2-19 - B2-28.

Experimental and theoretical results are presented on the influence of fine particles on pressure drop of sand/water mixtures in pipes. Results of experimental investigation of turbulence structure are given. Model is presented for explanation of phenomena.

0043 BRUINS, B. F. P. and BAKLER, N. 1977. "Offshore Dredging Study--Summary of Findings," Geological Survey of Israel Seminars, Jerusalem, Israel, pp 32-34.

Project objectives are to ascertain technical and economic feasibility of producing aggregates and other industrial minerals from offshore areas, to study effects of production on environment, and to assist Israeli Government in establishing producing centers, enterprises, financial planning, and technical specifications for plant and equipment. Drilling and laboratory results are summarised, and resource, market, technological and environmental bases described. Prospect drilling of calcareous sandstone (kurkar and calcarenite) and sand aggregates along Mediterranean shelf covered Haifa Bay and selected areas of Yafo-Tel-Aviv, Tel-Baruch, Netanya and Caesarea. Study of samples revealed following sediment types: crust, two types of calcareous sandstone, quartz-rich and biogenic-rich, brown coarse biogenic sand, grey fine quartz sand and loam clays. Calcareous sandstone as aggregate reserve is dominant in Haifa Bay. In most other locations calcareous sandstone submerges below overburden of recent fine sand.

0044 BUITEWEG, A. J. W. 1980. "Datalogging System on Dredgers," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 29-40.

Datalogging systems for dredgers as well as software for handling data are discussed. Data are used for building knowledge and off-site support of work execution. Systems may be extended to more advanced data acquisition with possibile on-site process control.

Different prototype systems were installed on trailing hopper and cutter dredger.

Extra signal transmitters were installed on trailing hopper dredger to obtain information for research and development. System measures about 60 signals. To reduce number of data bytes, dual scan interval periods are available for dredging and sailing. Magnetic tape cartridges are used for data storage because of high storage capacity, reliability, low error rate and robust construction.

System using micro computer for data reduction and calculation has been installed on cutter dredger. For both systems data processing is done ashore. Data are checked and converted to internally accepted standard. Several standard analysis and presentation programs are available.

Knowledge of dredging process gained through data logging will be used to develop dredger control systems.

0045 BURKE, T. D. and WYATT, C. E. 1980. "Using Propwash for Channel Maintenance Dredging," Proceedings, World Dredging Conference, WODCON IX, pp 609-620.

Kansas City District, Corps of Engineers, is responsible for maintaining a 9 ft by 300 ft navigation channel in Missouri River.

Shoaling often impedes navigation, sometimes requiring channel maintenance dredging. Because of slow response time and high cost of present dredging methods, tests were performed utilizing propwash to remove shoals. Modified landing craft (LCM) was fitted with deflector plates to direct propwash toward bottom.

Tests were conducted on operating methods and depth settings for deflector plates. Results demonstrated that LCM could effectively remove shoals in some areas. Control problems were encountered when operating LCM with towboat. Tests indicate that medium depth setting on deflector plates is most effective. Deeper settings increase vertical velocity vector, but decrease horizontal vector. Therefore, although bed material is agitated, it is not transported from immediate area. Shallow deflector plate settings did not induce bed material into motion.

Tests indicated that best operation method was LCM swinging from one spud to another, walking downstream. Tests also indicated that washing at one location for extended time periods was not effective because bar built up short distance downstream.

C

0046 CABLE, C. C. 1969 (Jan). "Optimum Dredging and Disposal Practices in Estuaries," Journal, Hydraulics Division, ASCE, Vol 95, No. HY1, pp 103-114.

Various types of dredging plant are described; their capabilities and limitations are listed. Importance of selecting most suitable disposal method is stressed. Emphasis on clean waters dictates studying alternate disposal methods to reduce pollution aspects. Trend is towards positive containment of dredged materials to reduce redredging and provide control over water quality.

0047 CAIN, J. D. and PEDERSON, D. 1980. "Automated Hydrographic Survey Systems for Dredging Operations," Proceedings, World Dredging Conference, WODCON IX, pp 239-250.

Complete spectrum of automated hydrographic data acquisition and processing systems required for dredging operations is illustrated by U. S. Army Corps of Engineers, Kewaunee Project Office Systems. Systems consist of microprocessor-based data logging and tracking system for small boat, more sophisticated Decca Autocarta for data collection and field processing aboard larger vessel and in-house hydrographic data center to process data into final format.

Both acquisition systems are interfaced to Decca Trisponder positioning systems. Depths are provided through Interspace depth digitizer.

In small boat system, positioning ranges are read and converted to state plane coordinates and depths are edited. Results are printed and stored on cassette tapes for processing. Outputs also drive X-Y Plotter which provides additional information.

Autocarta is sophisticated hydrographic collection system capable of producing final work charts, cross-sectional profiles and dredging volume quantities on board the survey launch.

Project Office data center consists of larger computer with flatbed plotter and three 2.5 megabyte hard discs. Data on cassettes from shipboard units are stored on disc. System processes these data utilizing more sophisticated capabilities.

0048 CAMPBELL, N. P. 1972 (Sep). "Development of Dredging Techniques," Civil Engineer in South Africa, Vol 14, No. 9, pp 291-302.

Inventions which led to principal dredge types in modern use are outlined together with methods of operation, capabilities and advantages, capital, running, and unit costs. Problems are described which confronted dredging industry from rapid revolution in shipbuilding practice and need to deepen sea approaches of established ports. Dredging problems at South African harbors and methods of handling them are described.

0049 CAMPBELL, P. L. 1975. "Automated Hydrographic Survey Systems," Proceedings, ASCE Specialty Conference on Civil Engineering in the Oceans, Vol 2, pp 1181-1189.

Effective automated hydrographic survey systems result in rapid collection and dissemination of bathymetric data for coastal and ocean engineering projects. Remote sensing recording and plotting equipment in an automated hydrographic survey must be carefully planned to maximize data reduction efficiency and minimize inadequate or inaccurate data. Practical guidelines for planning and conducting automated hydrographic surveys and disseminating results are provided.

0050 CARMICHAEL, J. W. and MACINNES, I. 1974. "Performance Assessment of Self-Dredging Harbour Entrances," Proceedings, Fourteenth Coastal Engineering Conference, ASCE, Vol 2, pp 1491-1502.

Paper provides information and assessment of three harbor entrance wave traps at Dingwall, Inverness, and Pleasant Bay, Canada. These were constructed to reduce amount of maintenance dredging in entrance channels. Wave climate data and littoral material analysis are presented. Observations on performance are given and conclusions drawn as to restrictions on applicability.

0051 CARSTENS, M. R. 1969 (Jan). "A Theory for Heterogeneous Flow of Solids in Pipes," Journal, Hydraulics Division, ASCE, Vol 95, No. HY1, pp 275-286.

Theory for flow of heterogeneous mixtures is derived assuming that existence of bed deposits is principal cause of observed differences between heterogeneous mixture flow and single phase fluid flow. Theoretical solution is in qualitative agreement with observed flow characteristics. Theory indicates that head loss varies nonlinearly with concentration and that: (a) higher head losses with heterogeneous mixtures result from bed deposits and (b) minimum head loss at constant concentration results from finite bed deposit rather than incipient deposition.

0052 CARSTENS, M. R. and HAGLER, T. W., JR. 1964 (Nov). "Water Hammer Resulting from Cavitating Pumps," Journal, Hydraulics Division, ASCE, Vol 90, No. HY6, pp 161-184.

In transporting phosphate ore slurry in a pipeline containing pumps in series, a pump will occasionally "blow up." Previously investigated failures stemming from water hammer as the result of rapid valve closure or power failure are not applicable to slurry pipelines. Consequently, a model pipeline with three pumps in series was constructed to determine the water hammer generation mechanism. Water hammer was found to be generated as liquid columns collide when vapor cavities decay at cavitating pumps. Theoretical results of complex flow situation are treated by graphical shock wave analysis. Engineering solution is simply to prevent pump cavitation.

0053 CASCIANO, F. M. 1976. "Submarine Sand Recovery System: Keauhou Bay Field Test," Report No. UNIHI-SEAGRANT-TR-77-02, University of Hawaii, Honolulu, Hawaii.

Small portable ocean sand mining system was tested near Keauhou Bay, Hawaii, using state and local industry matching funds. Test purpose was to assess technical, environmental, and economic feasibility for beach restoration and other commercial applications. Basic component is a suction probe which burrows beneath sand surface to extract sand. Probe was found to function well to overall depth of 85 ft and seas up to 6 ft. Although probe created more turbidity than expected due to way in which sand collapsed into craters, no detriment to environment due to turbidity was apparent. Projected costs for sand produced by system are $3.00 to $5.50 per cubic yard, depending on volume recovered.

0054 CAVALLIN, J. E., BEMIS, C. G., and HALEY, S. C. 1977. "The Vibratory Corer in Offshore Investigations," Proceedings, Ports '77, ASCE, pp 308-319.

Vibratory corer is widely used in unconsolidated sediments where required penetration depth is less than 40 ft. Sampler obtains complete stratigraphic sequence of materials and penetration data that can be correlated to sediment engineering properties. Vibratory corer is used to evaluate dredgability, scour potential, engineering properties such as strength and compressibility, and mineral, chemical and biological composition. Since late 1960's, Woodward-Clyde Consultants has used the vibratory corer on scores of projects such as harbor dredging studies and investigations for platforms and pipelines. Paper describes vibratory corer operation and limitations in offshore investigations. Paper also presents examples of application to common offshore projects.

0055 CAVE, I. 1976. "Effects of Suspended Solids on the Performance of Centrifugal Pumps," Proceedings, Hydrotransport 4, BHRA, pp H3-35 - H3-52.

Test results on slurries of different solids in different sized pumps are examined to determine separate and collective effects of variables involved. General empirical expression is derived for estimating performance of any pump on any slurry.

0056 CHASTAIN, G. E. 1978 (Apr). "The U. S. Army Corps of Engineers Permit Program," Shore and Beach, Vol 46, No. 2, pp 13-16.

Permit program and basic understanding of procedures involved are outlined. Army Corps of Engineer (ACE) regulatory responsibilities, are illustrated. Application of laws and steps in carrying an application through are described. Permits are issued under four laws. Most important legislation is River and Harbor Act of 1899, Federal Water Pollution Control Act (FWPCA) Amendments of 1972, and National Environmental Policy Act (NEPA) of 1969. Sections 9-20 of River and Harbor Act of 1899 remain as most important laws governing regulatory function of

ACE. 1972 Amendments to FWPCA combined existing environmental legislation into one act and added new items, including Section 404, making it illegal to place fill material or dredged material in navigable waters without an ACE Permit. From NEPA stems requirement for environmental impact statements. Three hypothetical cases based on amounts and sources of objection are presented to demonstrate procedure in processing permit application. Another method of handling certain types of situations is General Permit. Its requirements are given.

0057 CHAZITEODOROU, G. and WIENEN, A. 1977 (Feb). "Application of the Air-Lift Method for the Haulage of Manganese Nodules from the Deep Sea," Marine Technology, Vol 8, No. 1, pp 9-18.

Hydropneumatic solids transport as suspensions in pipelines has been provided for recovering deep sea manganese nodules because this system is simple, cheap, adaptable and - compared with mechanical continuous conveyers - needs little space and maintenance. For these reasons, experts forecast a large boom for this transport method. Some publications on hydropneumatic haulage contain calculation methods unsatisfactory in accuracy and general validity. It was necessary, for calculating the entire pressure loss (i.e. due to acceleration, height difference, and friction), which is decisive for hauling output and reachable delivery head, to replace additive superposition of pressure losses by physical interaction of all parameters. This can only succeed by using coupled differential equations to describe the phenomena. Thereby, not so much the individual processes but statistical considerations are important for precalculation.

0058 CHAZITEODOROU, G., STANGIER, W., and WIENEN, A. 1975 (Apr). "The Hydro-Pneumatic Haulage of Manganese Nodules from the Deep-Sea," Marine Technology, Vol 6, No. 2, pp 60-65.

Purpose of this investigation is calculation of a plant for hydro-pneumatic sea mining of manganese nodules. Results are evaluated and compiled as diagrams. A characteristic value Q_F/Q_L was found which depends on depth of blowing and hauling for certain air lift. Using this value, the quantity of air required Q_L may be determined for a given quantity of solids Q_F. Efficiencies of hauling, in the range of 23 to 35%, reach a maximum for individual depths so that future plants may be operated within an optimum range. Quantitative evaluation shows that haulage of manganese nodules in quantities from 130 to 220 Mp/h is possible from depths of 3000 to 5000 m. Results obtained on theoretical assumptions still require confirmation by experiments.

0059 CLAUSS, G. 1975. "Slip and Friction Losses in Deep-Sea Hydraulic Lifting of Solids," Preprints, Third International Ocean Development Conference, pp 293-308.

Conveyor systems presently under discussion for deep sea manganese nodule mining include airlift, jetlift and submerged pump systems as well as continuous bucket-line system. For hydraulic methods, transport mechanism is identical for lower 90 percent of piping. In all

cases rising flow of solid-water mixture in vertical pipe is characterized by slip and friction losses. Theoretical investigation is made to determine sinking velocity of single spherical particles and groups of particles as a function of particle diameter to pipe diameter ratio and spatial concentration. Flow resistance of freely sinking particle and pressure drag due to displacement of flow inside pipe caused by boundary layer separation behind particle are superimposed to result in total resistance of spherical particle. Results show that ratio of particle sinking velocity within a cluster to sinking velocity of unrestricted particles decreases rapidly with spatial concentration of solids in mixture. Theoretical relationship is confirmed by experiments with a 100 mm diameter pipe. To determine friction coefficient of mixture flow through pipe, resistance of a test section was measured. Experiments show that resistance is same as water for mixtures with solids concentration up to 5 percent. However, friction coefficient of mixtures with higher concentrations is considerably greater. Relationships thus determined may be used to optimize design of deep sea conveyor systems.

0060 CLEVELAND, N. 1976. "Some Proposals to Improve Placer Dredging," Proceedings, World Dredging Conference, WODCON VII, pp 821-831.

Article discusses use of bucket dredgers and questions need for two synchronised motors and two gear trains in main driver and trommel driven dredgers, suggesting that high efficiency and less wear can be achieved with one motor and gear train. Author suggests that placer dredge digging depth could be increased by up to 40 feet. He discusses disposal of suspended solids, termed slimes, comparing methods used in Malaysia with those in Colombia. Jungle trash, which becomes waterlogged and sinks through the slimes, can cause serious problems. Submersible dredge pump mounted near lower end of ladder would remove suspended solids when digging near bedrock.

0061 CLEVELAND, N. and GUNTERT, R. 1973. "Bucket Dredge Systems for Mining - Design Innovations," Proceedings, Ocean Mining Symposium OMS2, WODCON Association, pp 17-27.

Paper calls attention to need for dredge mining equipment that can dig to greater depths than conventional designs, have higher wave action toleration and handle larger volume of material than conventional dredges. At the same time, it should be simpler in basic design and more power efficient. Cleveland-O'Neill-Guntert continuous dragline concept apparently fulfills all these conditions.

0062 CLUTTERBUCK, P. G. and KIMBER, R. W. 1975 (Nov). "Latest Lines in Dredger Development," Civil Engineering (London), pp 25 and 27.

Article describes plant development by dredging industry to meet growing need for deep water access to industrial development. Cutter dredgers of 8,000 to 12,000 HP are discussed, particularly the "Jim Bean" and "Gravelines." Hydraulic excavators on pontoons and trailing suction

hoppers are mentioned, and "split-hopper" barges of 150 m^3 to 2000 m^3 capacity are described. Split-hopper system applied to trailer dredging is discussed, giving examples of the "Meerval," "Dragante," and "W D Medway."

0063 COLEMAN, M. J., WALLACE, H., and WEBB, R. J. 1975 (May). "Management Information for Dredging," Dock and Harbour Authority, Vol 56, No. 655, pp 5-7.

Research has evolved detailed management information system for trailer-suction dredging control at operational level. This is based on computer data handling methods using programs producing daily, weekly and monthly outputs.

0064 COLP, J. L., CAUDLE, W. N., and SCHUSTER, C. L. 1975. "Penetrometer System for Measuring In Situ Properties of Marine Sediment," Proceedings, IEEE Conference on Engineering in the Ocean Environment, pp 405-411.

Increased knowledge about ocean bottom sediments is sought for many purposes. A free-fall terrestrial penetrometer developed by Sandia Laboratories has been adapted as a low-cost system to gather information on sediment shear strength, pore water pressures, densities, heat flow, soil types, penetrability, acoustic properties, etc. Hard wire or acoustic data transmission link connects penetrometer instrumentation to surface recording/telemetry unit. Earlier versions have successfully penetrated up to 16.4 ft (5 m) in Gulf of Mexico sediments.

0065 CONDOLIOS, E. and CHAPUS, E. E. 1963 (Jul). "Operating Solids Pipelines," Chemical Engineering, Vol 70, No. 15, pp 145-150.

Previous articles in series concentrated on design. To end three part series, authors review problems in operating solids pipelines. Various installations are reviewed such as gravity types, pumping stations using sludge or solids pumps, stations having clear-water pumps and suction, and dredging and filling installations. Brief review of types of pipes and pumps is provided, listing advantages of each depending on installation and type of slurry to be handled.

0066 COOPER, H. R. 1975. Practical Dredging and Allied Subjects, Brown, Son & Ferguson, Ltd., U. K.

Author set himself the task of surveying all practical aspects of dredging. Book does not give hard and fast rules for dredging operation, but general guidance based on experience, in many instances illustrated by examples from field work. Text is entirely descriptive and devoid of mathematics. Driving machinery and pumps are also not considered.

Book opens with brief history of dredging, then deals with practical soil mechanics and the part played by dredging in conservancy. Mention is made of the consulting engineer in survey work, and the importance of modern electronic aids in dredging and hydrographic surveys,

while two chapters are devoted to port layouts and construction of canals and ancillary works.

Different types of dredgers are described. Modern innovations and special craft are discussed. Following a description of operating and maneuvering trailing-suction and cutter-suction dredgers, consideration is given to choice of dredgers, evolution of dredging combines, economic methods of dredger construction, dredger gear, and equipping vessels. There are separate chapters on rope techniques, reclamation, mooring, dumping, diving and underwater blasting. Instrumentation is covered by chapters on navigation and communications. Book concludes with chapter of miscellaneous notes and appendices of conversion factors and standard data.

0067 CORNELIS, C. A., LOHMAN, T. A. M., and DE KEIZER, C. 1980. "Dredge Automation by Means of Computers," Proceedings, Third Internatinal Symposium on Dredging Technology, BHRA, pp 41-58.

Automation has no purpose of its own, but is an instrument to increase overall productivity of dredge systems. To analyse the impact of automation on productivity a break-down of productivity in several elements and their interrelations is described.

Computer technology is related to the dredging process and the man-machine relation. The man-machine concept is explained in relation to dragarm handling on a trailing suction hopper dredger.

Description of a bucket dredging process computer shows how conventional hardware solutions are substituted by software solutions.

Improving software and integrating more functions into the system shows how a more sophisticated man-machine system was implemented on a cutter dredger.

0068 CORNET, R. 1975 (May). "Wear in Dredgers," Dock and Harbour Authority, Vol 56, No. 655, pp 10-12.

Wear is inevitable with hydraulic dredging. Qualitative and quantitative facts are given about wear encountered on hydraulic dredgers. Major influences on wear rate are mean grain diameter, mixture velocity and pump and pipe material. For steel and iron, hardness is significant. No relation was found between mixture density and wear rate, nor between pressure and wear rate.

0069 COX, J. H. and WILSON, J. 1978 (May). "Development of Sand and Gravel Suction Dredges," Naval Architect (London), No. 3, pp 101-120.

Article deals with dredges recovering sand and gravel, their development, and systems of loading and discharging. Need is emphasized for naval architect to be coordinator, paying special attention to allied services and technologies such as soil mechanics, hydraulics, etc., to develop ultimate potential of these highly specialized ships. In view of recorded losses, special attention has to be given to stability requirements and method of investigation in order to ensure a safety level equivalent to cargo ship of similar size.

0070 CRUICKSHANK, M. J. and HESS, H. D. 1975. "Marine Sand and Gravel Mining," Oceanus, Vol 19, No. 1, pp 32-44.

Authors discuss land-based sand and gravel mining and consider an alternative source - the continental margin, including the coastal zone and outer continental shelf. Table of capital costs is included. Estimates of sand and gravel resources are given, and nature and occurrence of resources described. Authors compare mining methods, giving examples of reclamation work in San Francisco Bay and experimental work by U. S. Army Corps of Engineers. Environmental problems associated with dredging are discussed, with special reference to pollution. Probable future operations are indicated together with estimates of annual sand and gravel production from outer continental shelf. Major research areas are suggested by need for resource conservation and environmental management. Mining sand and gravel on U. S. continental margins is near future development of importance to industry and consumer. Sound resource management practices could prevent or minimize damaging effects of mining operations.

D

0071 DAILY, J. W. and CHU, R. K. 1961. "Rigid Particle Suspensions in Turbulent Shear Flow: Some Concentration Effects," Technical Report No. 48, Massachusetts Institute of Technology Hydrodynamics Laboratory, Cambridge, Mass.

Report describes effects of changing suspension concentration of rigid spherical particles in fully turbulent shear flow in a pipe. Measurements of mean flow characteristics and turbulence intensity and spectra are compared with theoretical expectations. Measurements show for increasing concentrations at the same volume flux through a circular pipe (1) increased energy loss and shear stress, (2) reduced mean velocity gradients, and (3) reduced center line velocity. The last is opposite to reported results for two-dimensional decelerating open channel flow with smaller spheres in suspension. However, findings are consistent with integrated description of flow mechanics which includes (1) motion of shear transmittal to wall by liquid viscous action, and (2) increased momentum transfer through particle collision. Phenomenological analysis agrees with velocity defect and friction loss data. Measurements also indicate increased longitudinal turbulence over water as particles are added. Qualitative discussion of particle effects on turbulence structure and turbulent energy balance and dissipation is included.

0072 DAILY, J. W. and ROBERTS, C. P. R. 1964. "Rigid Particle Suspensions in Turbulent Shear Flow: Size Effects with Spherical Particles," Technical Report No. 69, Massachusetts Institute of Technology Hydrodynamics Laboratory, Cambridge, Mass.

Flow characteristics of spherical, almost neutrally buoyant rigid particles, size range 0.0102" - 0.0166" and volumetric concentration 15%, were determined in turbulent shear flow in a horizontal two inch diameter pipe. Objectives were to investigate particles of intermediate size range between 0.023" and 0.0047" to establish more accurately particle-probe interference effect and determine "true" particle effects. Impact probes of sufficiently large diameter were used so that particle effect was negligible. It was found that suspensions have sharper velocity profiles as well as higher maximum velocities than water. Friction factor was higher than Newtonian value at same volume flux and increased with concentration.

Results for "fine" particles were compared with previous investigations of both "fine" and "coarse" particles and a consistent pattern obtained. No reversal in previous findings was obtained after shear and particle effect corrections were applied. Coarse particles give friction factors between Newtonian and fine particle values. However, coarse particles in contrast to fine particles give fuller profiles. Von Kármán constant for core region shows small changes from Newtonian value, increasing for coarse particles and decreasing for fine particles.

0073 DAILY, J. W. and SHEN, C. C. 1964. "Rigid Particle Suspensions in Turbulent Shear Flow: An Improved Flow Facility and Measurement with 0.0255 Inch Spheres," Technical Report No. 68, Massachusetts Institute of Technology Hydrodynamics Laboratory, Cambridge, Mass.

To detect small change of mean turbulent pipe flow characteristics with suspensions from those of single phase fluid flow, a new test setup and instruments capable of accurate measurements were designed and constructed. Two modes of operation are a partially closed circuit for regular tests and an open circuit for discharge calibration. Friction loss is measured in a 2" diameter stainless tubing 41 ft long. Velocity distribution measurements are made in a 2" diameter lucite test section with an impact probe/static pressure tap combination. Theoretical analysis and experimental investigation was made into laws for velocity distribution and friction loss of flowing suspensions. Theoretical result agrees with analysis of Daily and Chu and indicates velocity distribution can be represented by Prandtl-von Kármán logarithmic equation if von Kármán constant k is replaced by k_m, which varies with particle properties and concentration. Impact probe measurements revealed that with 15% volume concentration of spherical particles in water (nominal diameter 0.0255", specific gravity 1.031), k_m values for both wall and core regions are greater than respective k values for water without particles. This indicates blunter profiles than for water.

Friction law deduced from theoretical velocity distribution equation and friction loss measurements both show friction factor f increases when particles are added to water.

Particles affect impact probe pressure measurements even though probe opening is two to four times particle diameter. Effects are most pronounced in zone of high corrections for shear and wall proximity.

0074 DAVIS, R. C. 1967. "Cubic Autotape Electronic Positioning Equipment in Cook Inlet, Alaska," Proceedings, World Dredging Conference, WODCON I, pp 453-459.

Paper outlines use of Cubic Autotape electronic positioning system by Frank Lindsey and Associates in Anchorage, Alaska. Although work described involves pipe laying barge, positioning information may be equally applied to dredge positioning requirements.

Pipeline surveys require positioning equipment for survey boat and lay barge. Equipment is used:

(1) During preliminary alignment survey to position sounding vessel.
(2) During final alignment survey.
(3) To continually position lay barge during actual pipeline construction.

Autotape system electronically measures distance from barge to two shore stations, providing barge position at all times. Distances are automatically measured, displayed and printed once each second and can be synchronized with a fathometer. Under typical field conditions measured distances are accurate to within a few feet.

Shore based responders and shipboard interrogator operate from 12-volt car battery. All instruments are small, easily portable and simple to operate. Voice communications are provided between interrogator and each responder.

0075 DAVISON, C. J. 1980. "Coping with Wear," Proceedings, World Dredging Conference, WODCON IX, pp 645-664.

Each year the Corps of Engineers removes approximately 18 million yards of sediment from West Coast harbors and river channels. Majority of this material is hard, abrasive sand collected by seagoing hopper dredges and pipeline dredges. Due to costly "downtime" of dredging plants, it is important that extreme wear and abrasion is minimized. This requires that all dredging system components (pumps, pipes, hoppers, etc.) have efficient long-wearing surfaces. Portland District believes that the Oregon and Washington coast has most abrasive material dredged by Corps of Engineers, and that area would be logical choice to perform tests on abrasion-resistant material. This is especially true in 1980 when Mt. St. Helens erupted and blocked Columbia River with boulders and abrasive volcanic material. This requires an ongoing program of testing, monitoring, and evaluating latest available coatings, both metallic and nonmetallic, for best combination of cost and wear rates.

0076 DE BREE, S. E. M. 1975. "The Abrasion Behaviour of Materials for Dredger Components, Due to Sand-Water Mixtures," Proceedings, First International Symposium on Dredging Technology, BHRA, pp G3-35 - G3-57.

Abrasion of dredge parts by water/sand mixtures is related first with type of sand and mixture specific gravity, and second with type and quality of component materials. Fundamental forms of abrasion are distinguished. Abrasion studies have been performed in two ways, namely fundamental research in the Mineral Technological Institute laboratory and field research work in actual dredger practice. Well-known standard wear tests have been carried out in the laboratory for a long time; additionally field research results have motivated abrasion testing stations for directed, accelerated studies. This equipment has allowed testing of wide variety of construction material types and composition. Tests have provided inside knowledge of wear behavior of several material types. State of material under review, i.e. structure, hardness and mechanical properties, are variable factors. Results are used to optimise materials selection for actual service.

0077 __________. 1976. "Centrifugal Dredge Pumps," Ports and Dredging & Oil Report, Vol 88, pp 4-10.

Author describes use of intermediate, or booster, stations in delivery pipeline. Effect of introducing such a unit is similar to employing a multi-pump, series-connected installation in the vessel. However, there are significant problems associated with booster use, e.g. position in delivery pipeline, effect of this when working at alternatively short and long delivery distances, and controlling booster during dredging process.

0078 DE BREE, S. E. M. 1976. "Centrifugal Dredge Pumps," Ports and Dredging & Oil Report, Vol 89, pp 6-11.

Author considers criteria for positioning booster pump in dredge delivery pipeline. If booster is too far behind dredger, low or negative pressure at booster inlet may produce water hammer. High pressure, if booster is too close, will demand very robust pump components which will need replacing prematurely. Pressure patterns along delivery pipeline are described.

0079 _________. 1977. "The Loading of Hopper Dredgers," Ports and Dredging & Oil Report, Vol 92, pp 4-8.

Author discusses loading of hopper dredgers. Filling system should ensure even loading of hopper where rapidly settling materials are dredged, but loading should not take place so fast that dredged material flows straight through hopper and is lost through overflow. Optimum loading time, influence of soil type on overflow losses, and effect of pump delivery rates are considered. Losses can be reduced by ensuring that dredged solids have time to settle, and by correct design and positioning of overflow weir. Different diffusers on delivery pipe are described, as well as effects of shape and dimensions of hopper.

0080 _________. 1977 (Aug). "Hopper Dredge Loading Problems Considered," World Dredging and Marine Construction, Vol 13, No. 9, pp 20-23.

Article deals with hopper loading process in its relationship to distribution and loading systems, shape of hopper, and provisions for carrying off surplus water. Author emphasizes that these are three of many of factors governing output of trailing suction hopper dredge and that output of installation as a whole is governed by weakest link in chain.

0081 _________. 1977 (Jan). "Uses of Plastics and Rubber in Dredging Applications," Plastica, Vol 30, No. 1, pp 1-9.

Several types of rubber and plastics can be used in dredging operations. Some practical examples are described, as are pertinent criteria. Use of polyurethanes for production of engineering parts is illustrated.

0082 _________. 1980 (Oct). "On the Erosion Resistance of Steels in Water-Sand Mixtures for Application in Dredge Pumps," Proceedings, World Dredging Conference, WODCON IX, pp 621-632.

Tests under mixed abrasive/impact erosion conditions were performed with new Toegepast Natuurwetenschappelijk Onderzoek (TNO) test rig at speed of 30 m/s and angles of attack between 10 and 90 degrees. For two frequently applied steels, relation between specific erosion rate and mixture density is analysed in detail. A maximum in erosion rate/mixture density curve occurs at low sand concentration, i.e. between 0.01 and 0.1 vol.%. Steels with identical chemical composition

and hardness but different structures may differ considerably in erosion resistance.

0083 DE BREE, S. E. M., BEGELINGER, A., and DE GEE, A. W. J. 1980. "A Study of the Behaviour of Materials for Dredge Parts in Water-Sand Mixtures," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 299-314.

Dredge parts in contact with water-soil mixtures are subject to three major forms of erosion: abrasive, impact and cavitation. A special test rig was developed to study abrasive and impact erosion behavior. Typical problems have been solved, for instance:

- centrifuging or sedimentation of soil particles at high and low velocities, respectively
- grain size degradation during tests
- mixture overheating during high velocity testing
- water-soil mixture rotation, resulting in effective speed reduction.

Only small test samples and a short test period are required. Quantitative wear data are presented for three types of steel in water-sand mixtures with three different types of sand and two sand concentrations. Angles of attack were 10, 30, 60 and 90°. Standard speed was 30 m/s, but a few experiments were performed at 4 m/s. Test results can be used for:

- improvements in dredge parts shape and design
- better materials choice
- prediction of dredge parts lifetime.

Test results lead to conclusion that, as far as pump wear is concerned, water-sand mixtures with high solids concentration are more favorable than mixtures with low solids concentration.

0084 DEDEGIL, M. Y. 1976 (Jun). "The Jet-Lift System in Deep Sea Mining," Proceedings, Interocean '76, DM, pp 146-153.

For deep sea manganese nodule mining several methods have been suggested and discussed, among them lifting by slurry pumps, the two-pipe method and the air lift method. Although the jet lift method shows technical and operational advantages its use has hardly been considered because of low efficiency. Lifting manganese nodules from the ocean floor surpasses anything encountered in conventional transportation because of very large depths and nodule size. Installations successfully used for conventional transportation problems such as slurry pumps and air lift pumps would need redimensioning for deep sea mining, which would reduce their efficiency. When comparing installations specially dimensioned for deep sea mining the solids-handling jet pump appears very well suited to compete. Injector pressure increase is computed theoretically and compared with test results. It is shown how to calculate and dimension lifting installation. Calculation for lifting 500 t/h of manganese nodules from 5000 m shows power requirements of 60 kWh/t. Other lifting methods are not likely to undercut this power requirement.

0085 DE GROOT, R. 1972. "IHC Venturi Draghead: New Dredging Approach," World Dredging and Marine Construction, Vol 8, No. 11, pp 41-42.

IHC Venturi draghead uses vacuum energy more efficiently than current IHC visor-type and California dragheads. A 1/6th scale model head was tested, together with a conventional head model, in the Mineral Technological Institute towing tank. Measurements relating to mixture concentration and towing force required were made at varying flow rates, towing speeds and vacuums.

0086 DE KONING, J. 1968. "Some Remarks About the Interaction of Pressure Quantity Curves of Sand-Pumps and Pipelines Resistance Curves when Pumping Sand-Water Mixtures with Changing Sand Concentrations in Long Pipelines," Proceedings, World Dredging Conference, WODCON II, pp 507-536.

In 1961, Führboter studied the effect of heterogenic water/sand mixtures on centrifugal dredge pump performance. He obtained two important results:

a. Efficiency for pumping water is not influenced by addition of sand. However, when pumping coarse gravel and stones, part of the material is ground between the impeller and casing, causing loss of efficiency.
b. Pressure difference across the pump correlates with sand concentration as follows:

$$P_m = P_w (1 + 0.8 C_t)$$

Measurements were made in the Amsterdamsche Ballast Maatschappij laboratory on several sizes of pumps which supported Führboters results, with the exception that P_m was higher than predicted, especially when pumping fine sand.

0087 __________. 1970 (Apr). "A Suction Dredger in Sand Pits," Civil Engineering and Public Works Review, Vol 65, No. 765, pp 403-405.

Density flow in borrow pits up to 70 m depth is described. Field observations are reported from soundings. How the submerged sand pump changed the flow mechanism in borrow pits is discussed.

0088 __________. 1970. "Field Observations of Gravity Flow to the Suction Dredger in Sand Pits," Proceedings, World Dredging Conference, WODCON III, pp 349-378.

In hydraulic dredging the flow of slurries, hydraulic erosion and sedimentation play an essential role. When two-phase flow in dredging is analyzed, it appears that soil is liquefacted by two methods:

a. hydraulic erosion
b. underdigging

Material is transported by:

1. systems with hydraulic tractive force
2. gravity flow. Paper goes into details of gravity flow in deep borrow pits (up to 70 m depth).

Field observations and quantitative data are presented.

0089 DE KONING, J. 1978. "Customer's Requirements - Dredging Operations and Equipment Development," Proceedings, World Dredging Conference, WODCON VIII, pp 89-113.

Development of dredging methods and equipment has been influenced in the last two decades by the following: (a) size increase of oil-tankers and ore ships, (b) general increase of shipping activities, (c) changes in cargo handling methods, and (d) creation of industries at deepwater ports. These influences raise problems for dredging contractors and designers in the conception and building of dredging equipment. Paper evaluates various problems and proposes solutions.

0090 DENNING, R. A. 1967. "Automating the Hydraulic Dredge," Proceedings, World Dredging Conference, WODCON I, pp 53-73.

Logic-type control circuit for automating hydraulic dredge is developed based on analyzing the dredging process through degree of freedom and abstract algebra approaches. Analysis considers relationships between dredge controls such as pump speed and swinging wire tension and flow variables of velocity, density, pressure and vacuum.

0091 ________. 1971. "Dredging Flowmetering Techniques," Proceedings, World Dredging Conference, WODCON IV, pp 611-644.

Various techniques for measuring velocity and density of solids-water mixtures in dredge pipes are described, including advantages and disadvantages. Techniques include magnetic flowmeter, gamma-ray density meter, differential pressure techniques, acoustic techniques, thermal flowmeter, conductivity density meter, and others. Velocity and density are not sensed directly in any of these techniques but are inferred from more readily measured variables such as pressure, voltage and current to which they can be mathematically related. A number of these mathematical relationships are presented. Reasons for flowmetering the dredging process are discussed.

0092 ________. 1972 (Mar). "Monitoring the Dredge Flow," World Construction, Vol 25, No. 3, pp 15-18.

Flowmetering systems described were selected on basis of functioning successfully in solids-water flow environment. They are discussed in order of preference based on reliability and state of instrumentation art. Magnetic flowmeter appeared best suited for velocity measurement. Solids flow rate is calculated from velocity and density, which are inferred from pressure, current and voltage.

0093 DENNING, R. A. 1976 (Aug). "Hydraulic Dredging Costs and Operations," World Dredging and Marine Construction, Vol 12, No. 9, pp 6, 8, 12 and 15.

Hydraulic dredging costs and operations data are discussed with the objective of achieving most economical material removal under various job conditions.

Factors are furnished to adjust production and cost data to permit reliable comparisons of different size dredges. Concepts and methods described, such as key performance areas, productivity, typical dredging cost estimate, and feedback control facilitate assessing dredging costs and operations.

0094 ________. 1980. "Nomograph Solution of Solids Transport Problems," Proceedings, World Dredging Conference, WODCON IX, pp 341-354.

Nomograph and related equations are presented for predicting head loss of solids-water mixtures in a pipeline. Nomograph was specifically designed for typical sand/water mixtures encountered during hydraulic dredging. However, method is also applicable to materials other than sand. Solution is based upon theory and practical approach. Particle sizes and critical transition velocities are considered. Key to solution is turbulence transport theory described in paper.

0095 DENTON, D. N. 1977 (Nov). "Trinity River Rehabilitation Requires Jet Pump Eductor," World Dredging and Marine Construction, Vol 13, No. 12, pp 14, 17, 18, and 20.

Denuding of forests has caused large amounts of sediment to wash into Trinity River, California. Sediment accumulates and prevents salmon from spawning and reproducing. Federal and state agencies have combined forces to remedy this situation. Drag-line methods were discarded as costly and possibly dangerous to fish because of turbidity. Jet pump system with potential of avoiding these problems was tried. Components and procedure of system are described.

0096 DE QUEIROZ SAMBAQUY, L. and MOURA, R. M. 1972. "Dredging Bibliography Volume 1, 1950/1971," Latin-American Dredging Association, Rio de Janeiro; Brazil.

The first of 2 volumes contain 1993 items. Many are provided with abstracts. Indexes by author, title and subject are provided. Subject categories are: General works; Dredging specific project; Types of dredgers and special dredges; Barges and other auxiliary craft; Reclamation; Automation; Pumps and impellers; Cavitation; Cost and economy of dredging; Drilling and blasting; Spoil disposal; Deep sea dredging; River dredging; Equipment and instrumentation; Dredges' maintenance; Mining and dredging; Propulsion; Salvage and reconstruction of dredges; Safety in dredging work; Sand and silt movement; Depth sounding; Transportation of solid-liquid mixtures; Pipelines; Wreck disposal by dredging.

0097 DERENTHAL, R. J. 1980. "An Advanced Hopper Dredge Control Concept," Proceedings, World Dredging Conference, WODCON IX, pp 731-744.

Hopper dredge cuts often involve a mile or more of run to get a load and a considerable time and distance to dump and return to dredging area. It is important to minimize number of runs and ensure that runs are made on lines specified. For many years, visual controls were used. The trend now is to use electronic positioning equipment coupled with a variety of peripherals.

Dredging operation usually is preceded by a depth survey to determine dredging requirements and followed by a post-dredge survey. Requirements determined by pre-dredge survey are converted into a dredging plan, including cut lines and number of passes on each line to estimate time and cost of dredging. Positioning system is then used to assist dredge in carrying out this plan. First part of paper deals with techniques used with Autotape positioning system and associated peripherals to ensure that dredge operates on cuts as planned. Second part deals with developing dredging plan and the monitoring/controlling process on the dredge.

0098 DICKSON, R. R. ET AL. 1978 (Apr). "An Examination of a Dredged Channel Using Sector Scanning Sonar in Side-Scan Mode," International Council for the Exploration of the Sea, Journal du Conseil, Vol 38, No. 1, pp 41-47.

Sector scanning sonar adapted to side-scan mode was used to examine channel dredged in sandwave field at Longsand Head (Outer Thames Estuary). Performance trials were successful. Range and resolution were comparable with side-scan sonar, but automatic gain control permitted detection of seabed features unresolved by side-scan sonar. Resurvey of channel dredged through sandwave field indicated sections of major sandwaves removed by dredging had shown only limited tendency to reform in 3-yr period since dredging operations. System of dunes (5 m wavelength) had developed in fine infill material on floor of channel. Intermittent noise signals due to sediment movement were recorded by modified scanner system during each survey leg and provide some qualitative impression of sediment movement patchiness on sandwave crests.

0099 DIEPERINK, R. J. H. and DONKERS, J. M. 1978 (Apr). "Offshore Tin Dredge for Indonesia," Transactions, Institute of Mining and Metallurgy, Section A, Vol 87, pp A39-A46.

Article describes discovery and exploration of several small- to medium-sized tin deposits in area offshore of Indonesia. Feasibility study in which particular attention was paid to dredging equipment selection is described. Features of potential dredge designs and interesting points about selected dredge are discussed.

0100 DONKERS, J. M. and DE GROOT, R. 1974 (Apr). "Dredging at Sea," Mining Engineering, Vol. 26, No. 4, pp 22-25.

Main problems of sea dredging are connected with movement in waves and swells of surface vessels supporting dredging equipment. Paper describes concepts of technically and economically feasible equipment.

0101 DRABBE, J. G. 1978. "Dredging Contract and the Co-operation of the Parties Involved," Proceedings, World Dredging Conference, WODCON VIII, pp 63-68.

Paper is concerned with relation between government, civil, and mechanical engineers concerning enlargement of contract dredging activities. Discussion addresses "administrative" conditions rather than technical ones.

0102 DURAND, R. 1951 (Oct). "Hydraulic Transport of Gravel and Pebbles in Pipes," La Houille Blanche, Vol 6, No. B, pp 609-619.

Author describes model investigations and tests made in Laboratoire Dauphinois d'Hydraulique to ascertain flow conditions of mixtures of water and either coal, soot, pebbles, or sand in horizontal pipes.

Author pays particular attention to gravel and pebble transportation for a dredging project. Particle fall velocity follows three different laws according to particle diameter. Particles can therefore be classed in three categories for hydraulic transport, according to size. Investigations draw attention to importance of saltation for gravel and pebbles.

By generalizing fall velocity--mean velocity relationship for gravel and pebbles, transportation regime is shown to follow Froude's similitude. Head loss coefficient appears to be independent of particle diameter above a certain size.

Author concludes that although it was possible to determine general phenomenon laws, extrapolation to large sized pipes still remains uncertain.

0103 DURAND, R. 1953. "Basic Relationship of the Transportation of Solids in Pipes - Experimental Research," Proceedings, Minnesota International Hydraulics Convention, IAHR, pp 89-103.

Systematic investigations of solids transportation in pipes, including screened solids, natural and artificial mixtures, are described.

Experiments showed that distinction may be made according to grain size between "homogeneous" and "heterogeneous" mixtures. Another distinction may be made among heterogeneous mixtures between fine sand transported in suspension and gravel transported by saltation.

Influence was studied of several parameters: concentration, pipe diameter, mean flow velocity, and grain size and specific gravity. Results for pipe diameters from 1-1/2 to 28 in. and grain diameters from 1/10 to 4 in. are expressed on one graph.

E

0104 EINSTEIN, H. and GRAF, W. H. 1966 (Jan). "Loop System for Measuring Sand-Water Mixtures," Journal, Hydraulics Division, ASCE, Vol 92, No. HY1, pp 1-12.

Measuring device for water-sand mixtures, a Loop System, was tested. Loop System consisted of two identical vertical pipe sections with opposite direction. Head loss readings were obtained at both pipe sections. Summation of readings could be correlated with flow rate and difference was shown to be proportional to solid concentration. Experimental results were obtained in equipment especially developed for study of solid-water mixtures in pipe lines.

0105 ENDT, F. 1978 (Jul). "Jubail Project Required Complex Logistics," World Dredging and Marine Construction, Vol 14, No. 7, pp 14-18.

Adriaan Volker is building 3,000-million-guilder commercial port project at Jubail, Saudi Arabia. Scheduled for completion in mid-1978, project required complex logistics to get plant and materials to destination on time. Volker built and supplied village to house 1,200 construction and dredge people. Initially, 6 vessels with 3,000 tons of equipment and submersible pontoons with cutter dredges and other equipment unloaded using self-contained gear and personnel to overcome backups at ports. Transport included LASH barges, trucks, containers, RO/RO vessels, and small tugs. Stone quarried near Dhahran moved by train to coast and then by barges to Jubail for breakwater and seawall construction. All construction equipment and supplies were shipped from other countries, requiring 20 ships each carrying 5,000-6,000 tons. Machinery required spares for 7-8% of moving parts. 20,000-ton bulk carrier filled with cement and moored off site required fleet of vessels to shuttle between it and shore. Problems of temperatures, religious days, and other matters are mentioned.

0106 ERICKSON, O. P. 1967. "Deep Dredging with Suction Pipe Cutter Drive and New Dredge Machinery Developments," Proceedings, World Dredging Conference, WODCON I, pp 561-573.

Hydraulic dredging industry has accelerated ability to dredge harder materials, dredge deeper, pump at higher pressures and in rough seas. This is due to increasing competition requiring more horsepower on pump, cutter and accessory equipment, and reduced downtime. Closed T.V., remote controls, and automation are under development. Following improvements are discussed:

1. Dredging to 250' depth with suction pipe cutter drive using hydraulic suction boosters.
2. Fully lined dredge pumps using alloy steel liners that will outlast present pumps five to six times.
3. Gearless swing gear and spud hoist, electric or hydraulic.

4. Double and single cutter reduction gears, electric or hyraulic.

5. Cutters with quick change tooth points and blade sections, including suction pipe drive cutters.

6. Hofer valve for vacuum and pressure control.

7. Velocity and density meters showing discharge velocity and cubic yards per hour pumped.

0107 ERICKSON, O. P. 1968. "Special 48" Dredge for All Purpose Large Dredging Projects," Proceedings, World Dredging Conference, WODCON II, pp 800-811.

Paper discusses 48" dredge and shows that dredges can be built to handle large quantities of materials. 48" dredge pumping at 22 fps velocity and 30% to 35% in situ solids can pump 20,000 to 25,000 feet at 11,000 to 13,000 c.y. per hour and deliver material over 800 times further than a dragline, at a cost in average material of about $0.03 per cubic yard mile.

0108 ________. 1970. "Dredge Performance and Costs with Improved Hydraulic Techniques for Deep Dredging in Unclassified Materials," Proceedings, World Dredging Conference, WODCON III, pp 209-218.

The following items are discussed:

Dredging to 250' with a sectional tubular ladder having cutter end section offset about 20°. Dredge A-frame with alternate hoist locations. All purpose crane on deck house for handling anchors and equipment. Cutter drives and suction booster located in cutter end section. Power to cutter drives, hydraulic jet boosters, or ladder dredge pump passing through hollow trunnions and tubular ladder members.

Cost comparisons between hydraulic jet booster and dredge pump on ladder; between electric and hydraulic cutter drives. Cost comparison between hydraulic and bucket line dredges. Production performance between hydraulic dredges with standard and direct suction pipe cutter drives and between hydraulic and bucket line dredges in various materials.

0109 ________. 1975. "Special 54" Hydraulic Dredge for All Purpose Dredging Projects," Proceedings, World Dredging Conference, WODCON VI, pp 197-209.

54" dredge is described in detail. Advantages in suitable operating conditions are mentioned.

0110 EVANS, C. J. and MEEKE, I. B. 1977 (Jul). "Site Investigations for Dredging Projects," International Dredging and Port Construction, Vol 4, No. 8, pp 11, 12, and 15.

Article is primarily concerned with information aquisition on geological aspects of dredging projects. Authors consider planning site investigation, materials to be dredged, programming investigation, site investigation work and laboratory tests.

F

0111 FADDICK, R. R. 1975. "Pipeline Wear from Abrasive Slurries," Proceedings, First International Conference on the Internal and External Protection of Pipes, BHRA, pp G3-29 - G3-38.

Wear due to corrosion and erosion is discussed with examples showing relative wear rates for various slurries, effects of particle size, solids distribution, and slurry velocity on pipe wear, and relative wear rates of various pipeline linings. Recent wear test results are provided.

0112 FAHRENTHOLZ, S. R. 1976. "Offshore Area Echo Sounding System," Proceedings, Interocean '76, DM, pp 623-635.

Offshore Area Survey System is described. System employs a number of transducers mounted transversely beneath vessel on retractable booms. Equipment is able to automatically adjust beam widths for shallow or deep water. Depth data are recorded as longitudinal profiles drawn next to each other by Area Echograph, as cross-sectional profiles on Profile Echograph, or as contour lines on Contour Line Recorder. Tide and swell data can be provided by ultrasonic tide and wave meter on seabed. System has been installed on survey vessel.

0113 FALDI, G. 1976 (Aug). "Portable Dredge Pump Proves Adaptability," World Dredging and Marine Construction, Vol 12, No. 9, pp 19-22.

Article describes pump which works on piston effect of compressed air in three special cylinders. It can operate from land or water, or on one bank of a canal or wharf. Uses are suggested.

0114 ________. 1976 (Mar). "Versatile Plant Dredges at Any Depth, from Any Watercraft," World Construction, Vol 29, No. 3, pp 62-65.

New type of pump dredges muddy and/or sandy material at any depth. Pump is operated by compressed air and can be mounted on any type watercraft. Pump can also be mounted on mobile land unit for pumping concrete and mortar, or debris discharge during tunnel construction. Dredging techniques and specific applications are discussed.

0115 FERANEC, M., POSPISIL, J., and POLACH, J. 1970. "500-DBA-1400-210 Dredge Pump for Suction Dredges," Czechoslovak Heavy Industry, No. 8, pp 22-25.

High pressure dredge pump described is intended for pumping solids of 150 mm maximum grain diameter, 25% maximum volume concentration at maximum specific gravity of 1.2 kg/cu dm, with pump permitting salt water to be handled. Results of strain-gage measurements on casing are reported.

0116 FISH, G. F. 1974. The Solids Handling Jet Pump, Ph. D. Dissertation, University of Bath, U. K.

Dissertation outlines past work on solids-handling jet pumps and reviews practical and theoretical approaches. No theoretical studies of solids-handling jet pumps were found. Theoretical studies of jet pumps without solids suggest that integral moment equations can be used to predict events in mixing tube. Integral moment equations are developed to include solid material. Experimental rig was built with provision to eject air into pipe, which represented jet pump mixing tube. Ejected air entrained secondary air which contained polystyrene beads. Measurements made included wall static pressure, air velocity, and solids mass flow. Velocity and mass flow profiles were obtained for twelve axial locations. Data were used as input to computer program to solve integral momentum equations. Object was to compare experimental and theoretical axial pressure, velocity and solid concentration changes.

0117 FISHER, N. M. 1972. "Application of Hydraulic Power to the Bucket Drive of a Dredge," Transactions, Institute of Mining and Metallurgy, Vol 81, No. 782, pp A21-A30.

Problems encountered during installation of hydraulic equipment to drive top tumbler and bucket chain of dredge are described. Details are given of tests to determine torque characteristics of bucket drives. Hydraulic drive is compared with other drives, and respective abilities to overcome forces generated by drive characteristics are discussed. Advantages and disadvantages of hydraulic drives for bucket dredges are summarized.

0118 FLEMING, C. A. and HUNT, J. N. 1976. "Application of a Sediment Transport Model," Proceedings, Fifteenth Coastal Engineering Conference, ASCE, Vol 2, pp 1184-1202.

Mathematical model for wave sediment transport has been developed. Model has been combined interactively with numerical models of refraction, diffraction, longshore currents and circulation currents to predict local topographical changes in vicinity of cooling water intake basin for nuclear power station. It was necessary to optimise configuration of breakwaters forming basin to minimize sediment concentration at intake, estimate maintenance dredging quantities and investigate extreme events.

0119 FORSBERG, J. H. 1973 (May). "Rock Dredging in Finland," World Dredging and Marine Construction, Vol 9, No. 6, pp 31-33.

Design of catamaran-type underwater rock drilling ferry (URD) is described. URD has specially developed collar bow bolt. Advanced tower design permits nonstop drilling from three-meter depth to 20-meter depth.

0120 FORTINO, E. B. 1966 (Feb). "Flow Measurement Techniques for Hydraulic Dredges," Journal, Waterways and Harbors Division, ASCE, Vol 92, No. WW1, pp 109-125.

Hydraulic dredges are being equipped with metering systems that furnish direct readout of velocity, density, and solids flow rate. Two types of systems have been developed; one uses all-pneumatic instrumentation, the other all-electric. First cost of electric system is approximately four times that of pneumatic. Electric is more complex and generally beyond maintenance capabilities of dredge personnel. However, it is more trouble-free and faster in response. Pneumatic systems use instruments that sense differential pressures at purge taps in pipeline and deliver pneumatic signals. Electric system uses magnetic flow meters to produce velocity signal and radioactive density gage. Pneumatic and electric computation is used in respective systems.

0121 __________. 1973. "Model Testing of a Dredge Pump Gas Removal System," Proceedings, World Dredging Conference, WODCON V, pp 565-598.

Part I of paper discusses effects of gas on dredge pump performance, presents history of gas removal equipment and describes existing gas removal systems. Part II describes transparent model apparatus used to test gas removal effectiveness and presents test results. Presentations show effect of gas on dredge pump head/capacity curves and variation of pump discharge rate with percent gas flow. Part III is discussion of results. Capability of dredge pumps with and without gas removal equipment is analyzed. Comparisons are presented of dredge pump performance with and without gas removal equipment and of removal by rotary vacuum pump versus water-driven ejectors. Effectiveness of present vacuum controls is discussed and need for better controls and accumulator design is indicated. Role accumulator plays in gas removal is clearly defined. Part IV presents conclusions and recommendations.

0122 FOX, L. J. 1976 (Jun). "Automatic Positioning Systems Speed Dredging Operations," World Dredging and Marine Construction, Vol 12, No. 7, pp 24-27.

Author discusses application of computer based automatic positioning systems to dredging operations. Chief disadvantages were cost, complexity and reliability/maintainability. Motorola's Mini-Ranger data processor is claimed to be less complex and more reliable. Setting up and maintenance are described for application to hopper dredge operations.

0123 FRANCO, J. J. 1967 (Jan). "Model Study of Hopper Dredge Dragheads," U. S. Army Engineer Waterways Experiment Station, Technical Report No. 2-755, Vicksburg, Miss.

Investigation was conducted to determine factors affecting draghead performance and to develop parameters for design and operation of dragheads in sand. Study was conducted in 60- by 10-ft flume with 1:6-scale model of draghead and suction line.

Investigation was not sufficiently broad to develop all relations affecting performance of various dragheads. However, results indicated draghead performance is affected by shape and dimensions of draghead, position with respect to bottom, vacuum, and dredging speed.

0124 FRAZIER, D. M. 1978 (Jun). "Dredging-Inflation-Profit," World Dredging and Marine Construction, Vol 14, No. 6, pp 12-17.

Traditional accounting methods do not provide adequate capital recovery and return on investment for dredging industry over long time periods and during high inflation. High replacement cost of equipment, increased short-term interest rates, and increased costs due to environmental regulations are among factors making it difficult to estimate long-term contracts. Formulas are suggested utilizing accelerated depreciation, inflation rates, tax strategies, replacement costs, and other evaluations to arrive at sufficient cash reserves and adequate return to investors on their equity. Difficulties in using formulas are discussed. Comparison with mining industry is drawn.

0125 FRAZIER, D. M. and ERICKSON, O. P. 1973. "Cutter Suction Dredges in Mining Operations," Proceedings, World Dredging Conference, WODCON V, pp 29-38.

Article describes and compares cutter suction and bucket line dredgers. Profit or financial return on investment is used as measure of efficiency, and factors affecting operating costs are considered. These include geological factors, vegetation and organic matter in soil, water depth, waves, type of mineral mined, and design of dredging equipment.

0126 FRIDMAN, M. M. 1976. "Improving the Reliability of Hydraulic Dredge Cutting Head Hinged Support Frames," Gidrotekhnicheskoe Stroitel'stvo, Vol 12, pp 52-53.

Hydraulic dredge maloperation frequently results from failure of hinged connection between cutting head frame and machine body. Problem is discussed and data tabulated giving observed misalignments as measured on hydraulic dredges. These show that design limits are exceeded. Author gives diagrams showing alternative designs for this item of equipment. New method of design with design formula is given, and maximum permissible misalignment is listed.

0127 FRISBIE, H. L., HATCHETT, G. L., and VIGIL, A. E. 1975. "Deep-Sea Survey Systems," Preprints, Third International Ocean Development Conference, pp 399-412.

Paper describes system designed to extend man's senses into ocean depths. Deep-Sea Survey System grew from simple deep television camera system operating over single coaxial cable to complex telemetry system capable of many commands and information channels with photographic camera, strobes, electronic sensors, television camera, and lights.

0128 FUJII, H. 1974. "An Over-View of Dredging in Japan," Proceedings, World Dredging Conference, WODCON VI, pp 11-16.

Paper describes activities of Japan Dredging and Reclamation Engineering Association and gives brief review of present situation of Japanese dredging business.

G

0129 GAASTERLAND, D. A. 1980. "Concept, Design and Construction of the World's First Self Elevating Offshore Heavy Duty Cutter Suction Dredger: 'Al Wassl Bay'," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 79-88.

Costain-Blankevoort and Dubai Transport were awarded the contract for dredging 110 million cubic meters for the new Industrial Harbour at Mina Jebel Ali, Dubai.

A 17 km long approach channel 235 m wide by 16 m deep had to be dredged in open sea. Material was caprock and other hard formations and waves up to 4 m in certain months appeared to rule out conventional dredgers.

Costain-Blankevoort proposed a self elevating, walking dredging platform to carry out the offshore dredging. Preliminary design was worked out with various shipyards and an order placed with Mitsubishi Heavy Industries, Japan. Design was completed five months later and construction of the 9000 ton, eight legged unit took another six months. Since February 1979, the dredger has successfully worked offshore at Mina Jebel Ali.

0130 GAETHJE, H. 1980. "The Determination of Functional Inter-Relationships of Selected Parameters for Cutter Suction Dredgers with the Aid of Statistical Methods," Technical University of Berlin, Federal Republic of Germany.

Cutter suction dredges with various dimensions are examined, whereby suction pipeline diameter is studied in relation to other parameters - e.g. dredging depth, solid particle throughput, discharge pipeline diameter, material transport distance, and installed pump power. Data on individual variables are represented in diagrams and mathematically treated by regression analysis. Equations developed enable direct dimensioning of suction and discharge pipeline diameters for cutter suction dredges with given dredged material and transport rate. Equations provide information on relationship between pump power, delivery pipeline, transport rate, and transport distance.

0131 GAETHJE, H. and WIEMANN, V. 1978. "Technical-Economical Investigation of Dredging Costs of Hopper Suction Dredgers," Hansa, Vol 115, No. 21, p 1784.

Following a description of the dredging process and total working cycle, parameters based on analysis of 93 existing dredgers are made available for calculation by formula. Time cycles and cost factors are calculated in relation to distance between dredging and discharge location and to total working time of dredger.

0132 ________. 1979 (Aug). "Using a Computer Program to Determine Operational Costs of Trailing Hopper Dredges," World Dredging and Marine Construction, Vol 15, No. 8, pp 9-13.

Technical and economic components of computer program to determine cost of cubic meter of dredged material and dredge output in cubic meters of solids per working hour are discussed. Program was derived from data from 93 hopper dredges with hopper volume between 750 and 7,000 m^3. Equations are described. General conclusions were: costs increase linearly for increasing distance between dredging and unloading points; costs decrease for longer operational periods; and costs decrease for increasing hopper volume. Program offers tool to: determine economic feasibility of buying hopper dredge; vary factors in dredge cycle sequence to improve economic performance; calculate dredging costs using individual circumstances.

0133 GALENBECK, E. 1975. "Dredging Winches for the Sea-Going Bucket Dredger of the VEB Peene-Werft Wolgast," Seewirtschaft, Vol 7, No. 7, pp 412-415.

VEB Peene-Werft is building three sea-going bucket dredgers for A/V Sudo import, Moscow, and VEB Bagger, Bugsiev- und Bergungsreederei. Article describes winches used for manuvering.

0134 GANDHI, R. L. 1976. "An Analysis of Hold Up Phenomena in Slurry Pipelines," Proceedings, Hydrotransport 4, BHRA, pp A3-33 - A3-50.

Solids concentration inside slurry pipeline is likely to be different from input and output concentration due to solids hold up in pipeline. Hold up occurs due to concentration gradient over pipe cross section as well as differences in velocities of solids and slurry. Using equations for predicting concentration gradient and velocity distribution of liquid in pipeline, ratio of pipeline to input solids concentration was determined. Analysis shows that considerable hold up could occur even in absence of slip between solids and liquid. Discrepancy in predicted friction loss values using empirical models may be due to use of input rather than pipeline solids concentration.

0135 GANDHI, R. L., RICKS, B. L., and AUDE, T. C. 1975. "Control of Corrosion/Erosion in Slurry Pipelines," Proceedings, First International Conference on the Internal and External Protection of Pipes, BHRA, pp G4-39 - G4-52.

Control of corrosion/erosion in long distance slurry pipelines plays important role in determining economic justification. Mechanisms of corrosion/erosion and abrasion are examined with reference to slurry pipelines. Design considerations for minimizing abrasion in slurry pipeline and alternatives for controlling corrosion/erosion are discussed. Method of evaluating corrosion/erosion control alternatives is presented. Example illustrates use of this method. Methods for monitoring pipe metal loss are described.

0136 GAUNT, D. I. and WILSON, J. B. 1975. "Acoustic Monitoring of Dredge Behaviour on the Sea Floor," Deep Sea Research, Vol 22, No. 2, pp 91-97.

New pinger is designed to monitor dredging operations on relatively flat sea floors in any water depth. It is mounted in robust case immediately in front of dredge. Principle of operation is that pulse repetition rate of pinger changes when orientation goes from vertical to horizontal. Acoustic signal from pinger is received on hydrophone and displayed on facsimile recorder.

0137 GAUS, J. N. 1974 (Dec). "Hydraulic Dredge Digs at Deeper Depths," Hydraulics and Pneumatics, Vol. 27, No. 12, pp 69-70.

Author describes how hydrostatic transmission with horsepower limiter provides reliable, maintenance-free cutter operation.

0138 GIARI, M. J. 1976 (Dec). "Untangling Waterway Dredging Regulations," Transportation Perspectives, Vol 1, No. 2, pp 47-70.

Structure and problems of dredging regulations are examined, general solutions proposed, and ways to implement recommended actions suggested. Legal basis for dredging regulation and roles of agencies involved are summarized. Navigation regulations and water quality regulations are noted, and comments made on the Wildlife Protection Act. Laws and agencies related to land use are categorized and discussed. Regulations which originate from Federal environmental impact legislation are noted. General recommendations are presented relating to policy guidelines, cooperation of federal and state agencies, permit processing, simplified procedures, and better planning. Two prerequisites must be met before streamlining the regulatory process: indepth examination of each agency, its policies and procedures and how they relate to other agencies; Program to improve regulations must be comprehensive to change procedures at all levels--local, state and federal.

0139 GIBERT, R. 1960 (May-June). "Transport Hydraulique, Refoulement Des Mixtures En Conduites," Anales des Ponts et Chaussees, No. 3.

Systematic tests made at the Hydraulics Laboratory in Grenoble have resulted in empiric laws which will facilitate study of problems peculiar to hydraulic transportation of materials. Special emphasis on transport of sandy materials is given.

Important distinction is drawn between heterogeneous mixtures of materials larger than about 50 mm, which are the subject of study, and those containing finer materials which form light-weight homogeneous mud.

For heterogeneous mixtures, laboratory tests were made on pipes of 40, 104, 150 and 250 mm diameter while those on dredging sites covered pipes 580 and 700 mm in diameter. Material granularity used ranged from fine sand to gravel.

When no sediment deposit is formed, head losses follow a general law as follows:

Relative increase in head losses in horizontal pipe is proportionate to solid material concentration and factor ϕ which is a function of Froude's number and mean drag coefficient of grains. If there is deposition, head loss remains practically constant.

Paper also deals with vertical or sloping pipes.

0140 GLADIGAU, L. N. 1975. "Interactions Between Sand and Water," Proceedings, World Dredging Conference, WODCON VI, pp 261-294.

Paper describes experiments investigating behaviour of vertical suction tube picking up sand while traversing across a flat sand bed. Slotta's mathematical relationships are confirmed. Development of Double Venturi Solid/Fluid Flow Meter enabled maximum use of small supply of clean sand available.

0141 GOEDDE, E. 1978. "To the Critical Velocity of Heterogeneous Hydraulic Transport," Proceedings, Hydrotransport 5, BHRA, pp B4-81 - B4-98.

Critical velocity was investigated in test loops of 40 to 208 mm pipes and depending on grain sizes and concentration of natural matter. Solids were plastics, coal, sand and iron ore. Comparison of heterogeneous transport results showed best conformity was gained with Durand formula.

Method is described where critical velocity can be checked more objectively than by visual observation.

0142 GOHRING, H. O. 1976. "The Submersible Motor and Its Application in Ocean Engineering," Proceedings, Interocean '76, DM, pp 721-733.

Outline of submersible motor development is given. Applications mentioned include use of driving dredge pumps and lifting deepsea manganese nodules.

0143 GOODIER, J. L. and WATERS, D. S., JR. 1980. "Advanced Dredging Equipment and Dredged Material Transportation and Disposal Systems," Proceedings, World Dredging Conference, WODCON IX, pp 175-190.

Dredging plans of Corps' Mobile District include improvement of navigation channels providing access and egress into ports of Mobile, Pascagoula/Bayou Cosotte and Gulfport in the Mississippi Sound. Projects place a heavy work load on available industrial and federally operated dredges. Mobile District was funded development of international annotated bibliography of dredging equipment, dredged material transportation, and disposal. Paper summarizes findings of study. Current advances in dredges, dredge automation and instrumentation, pipeline and barge transportation of slurries, contained disposal and material compaction, and dewatering are noted.

0144 GOOMAI, W. D. 1978 (Mar). "Bucket Operations Electronically Monitored," World Dredging and Marine Construction, Vol 14, No. 3, pp 36-38.

Crane position indication system shows bottom of grab position in relation to base of crane. System consists of moving pointer meters and number displays to indicate positions of all crane critical parts.

Without calculation, crane operator can place grab in a precisely determined position and know whether bucket is fully open or fully closed. System underwent extensive performance into an automatic control system. Apart from early vibration-induced failures, instrumentation has performed well. Principal displays are slew angle of crane relative to its base; digital display of jib angle, displayed as resultant effective reach; digital display of bucket depth; amount which bucket is open; and distance of bucket from last place grab was closed. Principles of operation and measurement of accuracy are described. Operator acceptance of instrument has proved its accuracy. Bottom profiles taken after dredging show smoother bottom was achieved. System was installed on West-Ham's dredge W. D. GOOMAI.

0145 GORTON, M. S. 1970. "Comparative Full Scale Tests of a Jet-Pump on the Suction of a Twenty-Two Inch Hydraulic Dredge," Proceedings, World Dredging Conference, WODCON III, pp 119-139.

General Construction Company of Seattle, Washington, installed a PACECO "Jet Stream Pump" of peripherally located multiple orifice type on twenty-two inch discharge dredge WASHINGTON. Description of jet pump and appurtenances is given.

After jet pump was installed, it was difficult to substantiate that dredge output had been increased and that cost of operating and maintaining jet pump was warranted.

Shoals on the Columbia River offered a set of conditions that was uniform enough to achieve a meaningful jet pump concept test. Material was reasonably uniform, bank was deep enough to maintain full output, fill was of uniform elevation above constant river level and considerable variation in pipeline length was available.

0146 GOVATOS, G. and ZANDI, I. 1969 (Oct). "Beach Nourishment from Offshore Sources," Shore and Beach, Vol 37, No. 2, pp 40-49.

Preliminary report on techno-economic study to develop system of artificial beach nourishment. Scheme utilizes automatic submersible jet-pipeline to minimize wave effects. Basic unit may be used separately or in connection with other dredging equipment to transport sand. Economic evaluation of jet-pipeline in connection with hopper dredge is presented.

0147 GRAF, W. H. and ACAROGLU, E. R. 1967. "Homogeneous Suspensions in Circular Conduits," Journal, Pipeline Division, ASCE, Vol 93, No. PL2, pp 63-69.

Investigation determined head losses caused by solid-liquid mixtures flowing through circular conduits of variable slopes. Study concentrated on transporting mixtures in complete suspension. Head loss equations were developed and experimentally verified for homogeneous suspensions.

0148 GRAF, W. H. and WEISMAN, R. N. 1969. "Continuous Measurement of Water-Sand Mixtures," Proceedings, Twenty-Second International Navigation Congress, PIANC, pp 17-26.

Practicability of elbow meter as flow rate and solid concentration measuring device was presented. 90° bend with a circular cross section was investigated.

Discussion concerns results of experimental work and implications of results for sand-water mixture flow. Concentration ranged from 0% to 12% by volume. Data obtained were pressure drop across bend and head loss between stations 0.5 m upstream and downstream of elbow for various flow rates and concentrations.

0149 GRANVILLE, A. 1975 (Jul). "The Recovery of Deep Sea Minerals: Problems and Prospects," Minerals Science and Engineering, Vol 7, No. 3, pp 170-188.

Some properties of ferromanganese nodules and nodule deposits are described to provide basis for understanding of developments toward mining nodules. Developments are outlined, and attempt made to reach realistic picture of status and prospects of ocean mining.

0150 GREEN, C.E. and RULA, A. A. 1977. "Low Ground Pressure Construction Equipment for Use in Dredged Material Containment Area Operation and Maintenance - Equipment Inventory," Technical Report No. D-77-1, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Sixty vehicles were evaluated to determine capabilities for operating in confined dredged material disposal areas. Results represent vehicles that are commercially available or have undergone recent military testing and can operate in soft soils. Vehicles were divided into 6 payload classes. Vehicle performance was expressed in terms of go-no go and traction capability on 5 selected soil strengths that cover range of strengths measured in representative disposal areas. Soils data revealed that within a given site operational environment can be highly variable. Comparison of computed soil strength requirements with measured soil strength data indicated that commercially available vehicles can operate in all except lowest soil strength units.

0151 GREN, G. G. 1976. "Hydaulic Dredgers, Including Boosters," Proceedings, Speciality Conference on Dredging and Its Environmental Effects, ASCE, pp 115-124.

Purpose of paper is to develop an understanding of hydraulic dredging by tracing its early history and describing various types of hydraulic dredges and their use.

0152 GRISHKO, A. P. 1975 (Mar). "A Method of Calculating the Optimum Slurry Pumps Life Between Maintenance," Gidroteknicheskoe Stroitel'stro, Vol 3, pp 36-38.

Mathematical analysis of manner in which slurry pumps wear, and equations for estimating optimum engineering-economic time between pump maintenance are given. Theoretical analysis is supported by practical investigation on slurry pumps of U.S.S.R. manufacture. Dimensionless curves are presented with which optimum time can be determined when pumping various materials - loams, sands and gravels. Data are given of financial savings resulting from optimisation of time between maintenance.

0153 GROHMANN, K. F. and GAEMMERLER, H. 1971 (May). "Newly Designed Suction Dredger Combined with a Transport Vessel, Hydroklapp Hopper Dredger, 250 cu m," Aufbereitungs Technik, Vol 12, No. 5, pp 289-292.

Paper reports on design of new equipment which combines standard suction dredger device with Hydroklapp barge. Outstanding features are a) design matched to particular requirements of reclaiming gravel from a pool, b) automatic shuttle navigator which permits navigation on minimum area, and c) quick unloading after arrival at submerged stockpile. Unloading is during traveling or while turning vessel by opening it lengthwise.

0154 GULARTE, R. C., KELLY, W. E., and NACCI, V. A. 1977. "Threshold Erosional Velocities and Rates of Erosion for Redeposited Estuarine Dredge Materials," Proceedings, Second International Symposium on Dredging Technology, Vol 1, pp H3-23 - H3-30.

Work reported is concerned with threshold erosional shear stresses and rates of erosion for ocean redeposited polluted estuarine dredge spoils. To simulate near shore environment, a recirculating water tunnel was constructed. This allowed average velocity of eroding sea water, average shear stress of sediment and amount of material eroded to be continuously monitored during testing. Average velocities and corresponding shear stresses above which a marked increase in material suspended occurred were determined. Shear stresses and rates of erosions are compared with values reported in literature.

H

0155 HAAR, H. R., JR. 1974 (Sep). "New Orleans Port Lifelines Maintained Through Dredging," World Dredging and Marine Construction, Vol 10, No. 10, pp 30-33.

Dredging is done in two deep water passes of Mississippi River, wharves along river, Industrial Canal and Gulf outlet. Dredging operations and harbor work are described. Because of extremely high river stages during past 2 years, there has been almost year-round dredging in port area.

0156 HAGYARD, T., GILMOUR, I. A., and MOTTRAM, W. D. 1969. "A Proposal to Remove Sand Bars by Fluidisation," New Zealand Journal of Science, No. 12.

Method is proposed where fluidization is used to intercept coastal sand movement and dissipate sand bars in harbor entrances. Results of preliminary design calculations are given, together with approximate costs for Westport Harbor, New Zealand.

0157 HAND, T. D. and FORD, A. W. 1978. "The Feasibility of Dredging for Bottom Recovery of Spills of Dense Hazardous Chemicals," Proceedings, National Conference on Control of Hazardous Material Spills, EPA et al., pp 315-324.

Dredging is perhaps the only feasible means for recovery of 70 hazardous materials denser than and relatively insoluble in water. Previous experience with dredges to clean up hazardous chemical spills is extremely limited. Dredges are classified; each principal type is briefly described with a summary of major operating characteristics. Each type is evaluated for hazardous material recovery in 4 environmental settings--land and nonnavigable waters, rivers, ports and harbors, and open waters. Evaluation criteria include job size compatibility, solids content, resuspension of sediments and contaminants, dredging depth limitations, vessel draft limitations, debris and structural obstacles, hindrance to traffic, wave height, current limitations, and transportation-mobilization time.

0158 HARIHARAN, S. V. 1976 (Aug). "Hydraulic Dredging," Indian Ports, pp 15-21.

Author describes dredging processes and purposes of capital dredging, beach nourishment and maintenance dredging. Types of dredger available and problems which may arise during operations are considered. Dredging in India is discussed. Alluvial deposits and climatic conditions on the east coast of India cause high littoral drift, and harbor maintenance is carried out by sand bypassing.

0159 HEINEMAN, A. J. 1977 (Sep). "Corps Dredges Help Maintain West Coast Channels," World Dredging and Marine Construction, Vol 13, No. 10, pp 17-20.

Alternate disposal methods are being investigated by the Army Corps of Engineers (ACE) in Oregon and Washington. Portland District will undertake a bucket dredging experiment in upper Coos Bay channel and examine the ocean disposal site before, during, and after disposal to ascertain effects on environment. ACE also planned to dispose of material in flow lane of Columbia River just outside Willamette River mouth. Natural flow of Columbia River is expected to carry most material out to sea. Flow lane disposal of clean sand by cutterhead dredge and agitation removal into deeper water were also studied.

0160 HEINEMAN, A. and BECHLY, J. 1980. "High Speed Hydrographic Surveying," Proceedings, World Dredging Conference, WODCON IX, pp 217-238.

Increasing budget limitations, rising fuel costs, environmental concerns for wetlands, together with continually changing shoaling patterns are motivations toward increasing coverage and frequency of hydrographic surveys. Portland District, U. S. Army Corps of Engineers, has in recent years procured electronic and floating plant equipment so that goal can be realized within their river and harbor channel maintenance program.

0161 HENDRY, A. W. 1967. "Subaqueous Blasting and Rock Excavation by Hydraulic Cutterhead Dredge," Proceedings, World Dredging Conference, WODCON I, pp 575-591.

Discussion is given of types and structural strength of equipment needed to withstand subaqueous blasting. Plant requirement for excavating rocky materials by hydraulic cutter head dredges is discussed.

0162 HERBICH, J. B. 1962. "Modifications in Design Improve Dredge Pump Efficiency," Report No. 277.35, Lehigh University Fritz Engineering Laboratory, Bethlehem, Pa.

Study was concerned with development of efficient pump handling silt-clay-water mixtures. One phase involved recommendations for dredge pump design changes. Another phase was model investigation of four modified impellers performed with water and silt-clay-water mixtures. Variables included discharge (0-1200 gallons per minute), speed (1150 to 1900 revolutions per minute), and density (1000 to 1380 grams per liter). Analysis of data indicates certain modifications in exit angle and vane shape of impeller result in marked pump efficiency increase. Relationships between various parameters was established for all impellers investigated.

0163 __________. 1971 (May). "Dredging Methods for Deep-Ocean Mineral Recovery," Journal, Waterways and Harbors Division, ASCE, Vol 97, No. WW2, pp 385-398.

Mineral resources of sea are listed and dredging methods discussed, including suction dredging and air-lift. When pump is located

on a ship, dredging depth may be extended to 600 ft by jet pumps in suction line. When pump is located at bottom, dredging depth may be increased to 18,000 ft, provided sufficient power is available. Equipment was developed for specific purposes such as submersible dredge for beach nourishment or air-lift method for deep ocean mining.

0164 HERBICH, J. B. 1974. "Methods for Offshore Dredging," Proceedings, World Dredging Conference, WODCON VI, pp 545-563.

Methods suitable for pumping offshore sand to beach areas are reviewed. Feasibility of hopper dredges for beach nourishment has been demonstrated, but few projects have been conducted. Prototype underwater dredges have been used, but further development is needed and large dredges must be constructed. Semisubmersible and walking-platform dredges have been proposed, and these appear to have good possibilities for special situations. Sea-going cutterhead dredge appears to be most promising because of versatility and easy adaptation to various offshore dredging jobs.

0165 __________. 1975. Coastal and Deep Ocean Dredging, Gulf Publishing Company, Houston, Tex.

Author has made general survey of mechanical, hydraulic and suction dredging. Treatment is a synthesis of latest knowledge on subject, including investigations by author and descriptions of latest techniques. Fundamental principles are outlined and examples given of design calculations, e.g. of dredge pumps.

Two chapters are devoted to centrifugal pump theory and dredge pump design. Model techniques and dimensional analysis are explained, as well as cavitation, gas effects, and dredge pump characteristics.

Subsequent chapters deal with dredging methods, pipeline solids transport, and automation techniques.

Other aspects discussed are jet pumps, coastal and ocean engineering, sediment movement, and underwater construction. Final chapter discusses various effects of dredging on environment.

Appendices include symbols list, conversion factors, data useful to dredging engineers, and U. S. Government rules and regulations relating to dredging.

0166 __________. 1975. Proceedings of the Seventh Dredging Seminar, Texas A&M University Center for Dredging Studies.

Topics covered were: hopper dredge A. MACKENZIE, remote sensing on dredging projects, Dredged Material Research Program (DMRP), variables affecting performance of hydraulic pipeline dredge, catamaran hulls for sea-going cutterhead dredges, Port of New Orleans, problems associated with submarine pipeline construction, compressibility and strength of compacted dredging, permeability and drainage characteristics of dredging, concepts for dredged material reclamation, and effects of suspended and deposited sediments on estuary organisms.

0167 HERBICH, J. B. 1975. Proceedings of the Eighth Dredging Seminar, Texas A&M University Center for Dredging Studies.

Proceedings include 10 papers that describe physical factors affecting dredged material islands in shallow water environment, new concept for dredged material disposal, dredging operations in Galveston District, dredge material containment in nylon bags for beach stabilization, vessel traffic systems, environmental impacts associated with dredged material disposal, remote sensing in evaluating turbidity plumes, hydrologic and sedimentologic studies of offshore disposal area, and aquatic dredged material disposal.

0168 __________. 1977. Proceedings of the Ninth Dredging Seminar, Texas A&M University Center for Dredging Studies, College Station, Tex.

Topics presented were: stablization of coastal subaerial disposal sites in North Carolina; availability of sediment-adsorbed heavy metals to benthic organisms; feasibility of developing biological habitats on dredged material; phosphate mining by dredge; techniques for reducing turbidity with present dredging procedures; the future of dredging market; environmental aspects of dredging in San Diego Bay, California; corbicula manilensis phillipi in Arkansas River; cost-effectiveness of solids-liquid separation in dredged material disposal; research to dewater dredged material; primary consolidation and compressibility of dredgings; and stabilization of polluted dredgings by electro-osmosis.

0169 __________. 1980. "Operating Characteristics of Cutterhead Dredges," Proceedings, World Dredging Conference, WODCON IX, pp 191-204.

Survey was made to evaluate operating characteristics of cutterhead dredges in U. S. and overseas. Survey investigated: (1) physical characteristics, (2) how many are equipped with modern instrumentation, (3) average crew size, (4) percentage maintenance time, (5) operation in waves and swells, (6) type of pipelines used, and (7) dredging practices of U. S. and Canada compared with those of Europe and Asia.

Survey results are presented in two sections, one for U. S. and Canada, and the other for foreign dredges. Few dredges can operate in waves over five feet. Few U. S. and Canadian dredges have adequate instrumentation, but a majority of foreign dredges have magnetic flow meters, density meters and production meters. Other findings deal with dredging operation methods, operating time, etc.

0170 HERBICH, J. B. and COOPER, R. L., II. 1971. "The Effect of Solid-Water Mixtures on Cavitation Characteristics of Dredge Pumps," Proceedings, World Dredging Conference, WODCON IV, pp 535-560.

Purpose of paper is to summarize laboratory studies on effect of solid-water mixtures on dredge pump cavitation. Studies included silt-clay-water mixtures and sand-water mixtures. Results indicate mixtures cavitated at same specific speed as clear water. Critical net positive suction head remained same for mixtures as for water provided it was expressed in feet of mixture.

0171 HERBICH, J. B. and FLIPSE, J. E. 1978. "Technical Gaps in Deep Ocean Mining," Proceedings, Oceans '78, MTS/IEEE, pp 606-610.

Need for minerals on deep ocean floor has increased interest in deep ocean mining. Several consortia are testing mining systems. Authors examine incentives for test programs and report on status. Limitations of current exploration, surveying and resource mapping systems are discussed. Problems associated with collector-sea floor interface and ship-dredge system interface are defined. Instrumentation, data collection and transmittal, system control, and system evaluation techniques are developed with attention to areas where present technology is deficient. Authors consider impact and recommendations of several recent investigations in deep ocean mining.

0172 HERBICH, J. B. and GREENE, W. S. 1975. "Bibliography on Dredging (Third Edition), Volumes I and II," Report CDS-179, Texas A&M University Center for Dredging Studies.

Literature pertaining to dredging is compiled into six categories. Each category contains an author, subject, general, and key-word index. General index contains ordered numerical listing of all literature. Categories are:

Vol. I: Dredge pumps, Dredgers, Dredging methods, Environmental effects; Vol. II: Hydraulic Transport, Ocean Mining.

0173 HERBICH, J. B. and LAI, Y. K. 1975. "Stable Catamaran Hulls for Cutterhead Dredges," Proceedings, Seventh Annual Offshore Technology Conference, Vol 2, pp 433-439.

Dredge operating in open sea has six characteristic motions. Stresses on ladder and connection between discharge and floating pipeline are of particular importance. Suggestion is made to increase cutterhead dredge stability by a semi-submersible or catamaran hull design. Possibility of truss design used on offshore mining projects is mentioned.

0174 HERBICH, J. B. and MILLER, R. E. 1970. "Effect of Air Content on Performance of a Dredge Pump," Proceedings, World Dredging Conference, WODCON III, pp 141-161.

Study was conducted on one-eighth scale model of modified dredge pump. Controlled amounts of air were injected into lower end of model suction pipe. Small amounts of air did not materially affect pump performance. When air reached three to five percent by volume, pump performance dropped off sharply. More than 10% air caused complete collapse of pumping. Air content in fluid affected head developed by pump and rate of water flow.

0175 HERBICH, J. B. and SNIDER, R. H. 1969. "Bibliography on Dredging," Sea Grant Publication No.203, Texas A&M University, College Station, Tex.

Bibliography contains 238 entries divided into five parts: Dredge pumps, Dredging vessels, Ocean mining, Pipeline transport, and Miscellaneous.

0176 HERBICH, J. B. and VALLENTINE, H. R. 1961. "Effect of Impeller Design Changes on Characteristics of a Model Dredge Pump," Report No. 277-PR33, Lehigh University Fritz Engineering Laboratory, Bethlehem, Pa.

Study was concerned with development of efficient pump handling silt-clay-water mixtures. Part described here involved design changes of impeller and model investigation of four modified impellers. Work was performed with water and silt-clay-water mixtures. Variables included discharge (0-1200 gpm), speed (1150 to 1900 rpm), and density (1000 to 1380 grams per liter). Analysis of data indicates certain modifications in exit angle and vane shape of impeller result in marked pump efficiency increase. Relationship between various parameters was established for all impellers investigated.

0177 HERBICH, J. B., BASCO, D. R., and LANG, D. W. 1970. Proceedings of the Third Dredging Seminar, Texas A&M University Center for Dredging Studies.

Papers presented include: particle size and density effects on cavitation performance of dredge pumps; materials used in manufacture of dredge pumps; research needs of dredge pump manufacturer; report on WODCON 70; slurry flow in vertical pipes; water quality in dredging industry.

0178 HEWITT, J. A. 1978 (Jul). "Present and Future Trends in Capability and Design of Sea-Going Tin Dredges," Transactions, Institute of Mining and Metallurgy, Vol 87, pp A89-A95.

Description is given of offshore alluvial tin dredges of all types. Necessity of operating dredges during rough weather has led to designs that allow adequate swell, surge and heave compensations. Conventional bucket dredges have limitations beyond depths of 150-200 ft, therefore concepts must be developed for dredging below these depths. Two such systems are described - a continuous dragline concept and a multi-grab concept, the latter being considered more viable.

0179 HEYNEMANNS, R. 1971 (Oct). "Rubber-Lined Pump Innovation: A Cost Saver," World Dredging and Marine Construction, Vol 7, No. 11, pp 18-20.

Uredestein Bekledingstechnieken N.V. has developed pump lined with replaceable rubber lining. Lining has abrasion resistance 50 times higher than steel and 88 times higher than grey iron. Specially trained technicians are not needed to replace lining or repair pump, and casing

can be replaced in three hours. Outer casing can be depreciated over ten or more linings. Thus, pump costs can be drastically reduced. Same process can be applied to discharge lines, bends, valves, and other parts of dredging system.

0180 HICKS, W. 1975 (May). "Drag Scrapers in Dredges Speed Discharge of Cargo," World Dredging and Marine Construction, Vol 11, No. 6, pp 36-38.

Installation described incorporates twin scrapers, working side by side in hopper, being hauled up ramp to discharge into regulating hopper. From this hopper, material is transferred by continuous belt to end of boom conveyor beam with horizontal movement through 160 degrees and elevation to 35 degrees. Slatted conveyor belt is designed for high-angle discharge to allow clearance of shore obstacles and height of stockpiles.

0181 HILL, J. C. C. 1975. "Some Practical Experiences with Jet Pumps," Proceedings, Second Symposium on Jet Pumps & Ejectors and Gas Lift Techniques, BHRA, pp X7-X11.

Author outlines personal experience with jet pumps in mining tin and china clay and in dredging. Examples are given which include recovery of diamondiferous gravel, underwater sampling for mineral prospecting and silt dredging.

0182 HOBSON, R. D. 1977. "Effects of Dredging and Handling Techniques on Sediment Texture," Proceedings, Joint Session, American Association of Petroleum Geologists--Society of Economic Paleontologists and Mineralogists, Washington, D. C.

Field experiment was conducted to quantify effects of dredging and handling techniques on sediment textural properties. Sediments from entrance channel to New River Inlet, North Carolina, were sampled prior to dredging and resampled by coring hopper-barge loads before discharge at beach. Beach samples were collected to evaluate native beach composite properties. Comparisons of dredged and predredged sediment indicate average handling losses of 13%. Losses are from medium-to-fine sand sizes (1/2-1/16 mm).

0183 HOCHSTEIN, A. B. 1975 (Nov). "Optimum Dredged Depth in Inland Waterway," Journal, Waterways, Harbors, and Coastal Engineering Division, ASCE, Vol 101, No. WW4, pp 331-342.

Criterion for optimum depths in inland waterway is minimized value of tow industry cost plus waterway structures cost. In open rivers, the latter is mainly dredging cost. Plan described in paper represents simple solution to problem of optimal channel depth, useful for planning and economic estimates.

0184 HOFFMAN, J. F. 1977. "An Investigation of New Methods for the Maintenance Dredging of Pier Slips and an Investigation of Selected Dredging Problems in U. S. Navy Connected Harbors," Report No. USNA-EPRD-37, Naval Facilities Engineering Command, Alexandria, Virginia.

Research was divided into three parts. One part concerned new dredging methods of low capacity where use is confined to small area such as pier slip. Second part concerned problem of sediment accretion in Pier 12 at U. S. Naval Base, Norfolk, Va., and disposal of dredge spoil from channel deepening in Thames River at New London Submarine Base. Third part outlined lecture on dredging methods and problems for use at U. S. Navy Civil Engineering School, Port Hueneme, Calif. Six possible methods were evaluated: (1) agitation dredging; (2) Pneuma system; (3) eductors; (4) Dixie dredge; (5) Mudcat dredge; and (6) Marconaflo system.

0185 __________. 1978. "European Dredging - A Review of the State of the Art," Report No. ONRL-R-12-78, Office of Naval Research, Washington, D. C.

Results are given of three-month on-site investigation in Belgium, England, France, Germany, Holland and Scotland. Visited were two dredging firms, one manufacturer of dredging equipment, three universities, six laboratories concerned with hydraulics and/or sedimentation in harbors, eight port authorities, and three miscellaneous federal agencies. New dredging technology is discussed. Facilities and capabilities of hydraulic laboratories are described.

0186 __________. 1978. "New Methods for Dredging Pier Slips," Proceedings, Coastal Zone '78, ASCE, Vol 2, pp 1083-1097.

Seven methods of dredging pier slips different from those in common use are described. These methods are: agitation dredging, Pneuma system, eductors, Mudcat dredge, Marconaflo system, multi-jet sweep and small cutterhead dredgers.

0187 HOLLIS, C. W. 1976. "Legislative Impacts on Dredging General Regulatory Functions," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 1-9.

Individual states and Federal Government have enacted legislation implementing jurisdictional authorities over waters within their boundaries. Each piece of legislation has had an effect on construction activity such as dredging. Paper focuses on development of Federal law requiring regulatory control, evolution of the law, its administration, and its effect on dredging activities.

0188 HOLLOWAY, T. H. 1976 (May). "Shipping Operations in Marine Aggregate Dredging," Quarry Management and Products, Vol 3, No. 5, pp 173-176.

Paper discusses various aspects of marine aggregates dredging, including dredging developments through to modern practice with mention of ship utilization, shipping law, modern safety and comfort standards on dredgers, and equipment maintenance.

0189 HOLZENBERGER, K. 1978 (May). "The Indirect Hydraulic Transport of Mineral Raw Materials from the Deep Sea by Centrifugal Pumps," Proceedings, Hydrotransport 5, BHRA, pp F8-133 - F8-152.

Hydraulic transport of coarse-grained solids requires pumps exposed to erosion wear with higher flow velocities. For that reason, flow velocities, and therefore delivery heads, have to be limited. Indirect solids transport by centrifugal pump is not subjected to this restriction because solids do not pass through the pump. Such systems, known as pipe feeders, have been tested in mining. It is proposed to use this system for recovering manganese nodules from the deep sea. Construction and qualities of such a pump system are described.

0190 HOPMAN, R. J. 1971. "Operational Planning and Its Associated Problems for Dredging in the Pacific Northwest," Proceedings, World Dredging Conference, WODCON IV, pp 29-47.

Reasons that dredging navigable channels are presented. Approaches to depositing dredge materials are considered. Methods of coping with environmental demands are described. Systems analysis approach to identify and assess problems, techniques and objectives to improve maintenance dredging is given.

0191 HOPMAN, R.J. 1978 (Mar). "Channel Sweeping System Put to Use," World Dredging and Marine Construction, Vol 14, No. 3, pp 20-22.

Channel sweeping device used in deepening and widening operations of navigation channel at Coos Bay is described. Disadvantages of conventional wire drag system and advantages of channel sweeping system are stated.

0192 HOWITT, A. C. 1973. "Flexural-Mechanics and Its Application to Dredging," Proceedings, World Dredging Confernce, WODCON V, pp 799-816.

Paper deals with hose requirements in trailing suction, cutter suction and pipeline dredges and problems experienced which are largely created by misconceptions of duties, equipment design and operational practices. Paper touches on hydrodynamics and origin and control of surge pressures.

0193 HUNDEMANN, A. S. 1979 (Aug). "Materials Handling by Slurry Pipelines (Citations from the Engineering Index Data Base)," National Technical Information Service, Springfield, Va., p 248.

Worldwide research on slurry pipelines containing coal, crude oil, minerals, sand, gravel, metallic ores, industrial wastes, and municipal wastes is cited. Studies on pumps, pipes, fluid flow, hydraulics,

and design are included. Characteristics of transported materials are covered. Underwater pipelines and underground pipelines are also covered.

0194 HURST, G., NILSSON, G., and MICKELSON, P. I. 1980. "Rubber Liners for Dredge Pumps," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 129-136.

New method of reinforcing rubber makes it possible to use rubber wear parts in dredge pumps and improve lining economy compared to steel. Method and test results from rubber-lined pumps installed on dredges are described.

0195 HUSTON, J. 1967 (Aug). "Dredging Fundamentals," Journal, Waterways and Harbors Division, ASCE, Vol 93, No. WW3, pp 45-69.

Paper presents account of history, plant, operation, control and production of cutter-head dredge. Plant's components, how they function, how dredging is accomplished and methods used to measure and determine output are described. Recommendations are made concerning need for published dredging information.

0196 ________. 1976 (Apr). "Creating Better Contracts," World Dredging and Marine Construction, Vol 12, No. 5, pp 19-23.

Author discusses design work for dredging contract and stresses that enough cross sections and borings should be taken to determine quantity and quality of material to be dredged. Bridges, jetties, piers, overhead and submarine cables and other objects that might restrict dredging should be located. Hydraulic characteristics and tidal currents should be determined.

0197 ________. 1976. "Techniques for Reducing Turbidity with Present Dredging Procedures and Operations," Proceedings, World Dredging Conference, WODCON VII, pp 163-181.

Techniques for reducing dredge-induced turbidity fall in the categories of cutter, ladder, suction, hull, pipeline, connections, barges, tugs, personnel, inspection, and plans and specifications. Techniques consist principally of good dredging procedures already known, but not always followed. When these techniques are constantly applied, dredge-induced turbidity will be reduced and economical operation will result.

0198 ________. 1980. "Resolution of Dredging Contract Disputes by Arbitration and Mediation," Proceedings, World Dredging Conference, WODCON IX, pp 47-58.

Items discussed: prior systems of arbitration, American Arbitration Association, how to provide for arbitration and mediation in contracts, agreement of parties, initiation of arbitration, appointment and qualifications of arbitrators, rules.

0199 HUSTON, J. W. and HUSTON, W. C. 1976 (May). "Techniques for Reducing Turbidity Associated with Present Dredging Procedures and Operations," Contract Report No. D-76-4, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Techniques for reducing turbidity associated with present dredging procedures and operations fall in the categories of cutter, ladder, suction, hull, pipeline, connections, barges, tenders, personnel, inspection, contracts, plans and specifications. Techniques consist principally of good dredging procedures already known but not always followed by dredging contractors and their personnel. When these techniques are consistently applied, dredge-induced turbidity will be reduced and economical operation will result.

I

0200 ICHIRO, O. and KOYO, J. 1973. "Effect of Ejector System on Cutter Suction Dredger," Proceedings, World Dredging Conference, WODCON V, pp 507-530.

5,000 horse-power cutter suction dredger was equipped with an ejector in the suction pipe. Experiments and measurements were made to analyze and confirm ejector effects during dredging.

Following items were analyzed with and without the ejector:

1. Ejector efficiency.
2. Relationship between dredging depth and mixture density.
3. Relationship between dredge pump suction pressure and mixture density.
4. Relationship between dredging capacity and mixture density.

Analysis showed that:

1. Ejector performance during dredging is similar to calculations.
2. 30% increase in dredging capacity is obtained using ejector in fine sand.

0201 IKEDA, K. and MARIYA, H. 1975. "Development and Practical Use of Submersible Dredger," Preprints, Third International Ocean Development Conference, pp 359-380.

Submersible dredger (SD) was developed under subsidy of Japan Ship's Machinery Development Association. SD carried a dredging device, machinery room, ventilation tower, control capsule and spud device on a crawler into waters up to 7 meters deep. Prime mover is an electric motor. Power is supplied from a land line or non-utility electric generation plant via a submersible composite cable.

0202 INGHAM, A., ED. 1975. Sea Surveying, John Wiley and Sons, Ltd., London, 2 Vols.

Contents: Part one, The environment, introduction; The natural environment; The industrial environment; Environmental data. Part two, Position; General considerations; Geodesy, projections and grids; Shore control; The offshore fix. Part three, Sea surveying operations; Planning and preparation; Hydrographic surveys; Marine geoscience; Applied oceanography. Appendixes, Electromagnetic waves; Acoustics and sonar; Tides and tidal analysis; Automated surveys.

0203 IWATA, H. ET AL. 1970 (Sept). "Japan's Progress in Dredging Research," World Dredging and Marine Construction, Vol 6, No. 11, pp 19-41.

Technical progress in Japanese dredging industry is illustrated with five papers describing research on grab buckets, utilization of pusher barge line system, suction booster pumps, dredging hard soil and rock with cutter suction dredge, and sedimentation effects of soil in hopper.

J

0204 JACKSON, P. B. 1979 (Mar). "Tide Gauge Technology Aids Dredging," World Dredging and Marine Construction, Vol 15, No. 3, pp 28-29.

Summit Electronic Systems has developed new Radio Tide Gauge. System has weather- and accident-proofing features and shares channel with normal dredge radios, but messages are not confused by voices on channel. Multiple gauges in a dredging operation use 1 radio channel. Dredging depth display feature is built into gauge for dredges not equipped with profile cutting computers.

0205 JACOBS, B. 1975 (Nov). "Dredging R and D," Civil Engineering (London), Vol 70, No. 830, pp 41 and 43.

Author reports on three areas of dredging research and development of interest to BHRA Fluid Engineering: (i) Offshore oil drilling. Importance of dredging for sea bed platform bases is pointed out. Use of jet dredging or jet bedding principle is outlined. Further application is in trenching for pipe laying. (ii) Deep sea mining. Author discusses disadvantages of air-lift pump and development of buoyant particle pump. (iii) Measurement of wear and flow properties of water/solid mixtures. Description is given of BHRA work on wear in solids handling pumps and pipelines.

0206 JAMES, D. W. 1976 (May). "Growing Demand for Accurate Pre-Dredging Surveys," International Dredging and Port Construction, Vol 3, No. 20, pp 15 and 17.

Types of positioning systems, including Tellurometer MRB 201, and methods of minimizing repetitive dredging are discussed.

0207 JAMES, E. H. and ANDREAE, J. F. R. 1978. "Contractor's Response to the Complexity of Present Projects," Proceedings, World Dredging Conference, WODCON VIII, pp 53-61.

Paper shows how company organizations in dredging industry have responded to challenges through the years. They can no longer exist without modern technology and continued willingness to implement changes. Evolution of dredging company structures and present organizational requirements are discussed.

0208 JANSEN, H. J. 1978 (May). "A Trailing Suction Dredger with an Active Draghead," Dredging and Port Construction, Vol 5, No. 7, pp 15, 18, and 19.

Author describes Johanna Jacoba, a trailing suction hopper dredger fitted with an active draghead. Principle of active draghead is explained.

0209 JANTZEN, R. J. 1974. "Dredge for 1984," Proceedings, Sixth Dredging Seminar, Texas A&M University Center for Dredging Studies, pp 86-97.

Author discusses future development of dredge design and operation and factors influencing this development, such as environmental restrictions, energy crisis, more ocean work, long distance pumping and deeper digging.

0210 JEPSKY, J. 1980. "A Simplified Precise Radar Navigation System for Dredging, Channel Sweeping, and Surveying," Proceedings, World Dredging Conference, WODCON IX, pp 707-718.

System was developed specifically for dredging industry. System utilizes shoreside radar targets and provides position accuracy less than 5'r.m.s.

Display unit provides following data:

(1) Deviation from intended track or cut (feet, right or left)
(2) Distance to end of track or cut (feet)
(3) Vessel speed over bottom
(4) Attitude relative to intended track (angular difference between heading of dredge and azimuth angle of track)
(5) Range/range data or X-Y grid coordinates

System provides pre-programmed navigation information for transit to and from dump area in accordance with proposed U. S. Coast Guard requirements. System can also provide dredge head positioning, permitting slope dredging. System can interface with any existing X-band marine radar without impairing radar integrity.

0211 JOANKNECHT, L. W. F. 1975. "Results of Tests on Two Cutter Heads Operating in Sand," Proceedings, First International Symposium on Dredging Technology, BHRA, pp F1-1 - F1-20.

Paper presents results of investigations into performance of two cutter heads: a) conventional crown type cutter with six blades, each with eight teeth, scaled down from existing head 1:7, b) cylindrical cutter with cutting blades fixed between top horizontal ring and a bottom disc, mounted on vertical shaft. Shield within head leads soil cuttings into suction mouth. Conclusions are: a) volumetric efficiency and production per kW are better for cylindrical cutter, b) although production appears better for crown cutter due to larger size, relatively small height increase on cylindrical cutter should make production equal to crown cutter, c) cutting force increases only 25% against a threefold cone resistance increase, d) cutting force increases proportional to square of swing velocity.

0212 ________. 1976. "A Review of Dredge Cutter Head Modeling and Performance," Proceedings, World Dredging Conference, WODCON VII, pp 995-1016.

Paper outlines laboratory tests on two model cutters. Cutters are scaled down at ratios of 1:3 and 1:4. Experiments are restricted to sand with mean grain size 200 μm. Empirical scale rules are given for haulage velocity, mixture velocity, angular velocity and cutting force.

0213 JOCHEM, W. M. 1974 (Nov). "Doppler Sonar Aids Dredging," World Dredging and Marine Construction, Vol 10, No. 13, pp 37-38.

Hopper dredges were fitted with doppler sonar to aid in dredging deep water channel. Sonars helped in strong currents and tides. Cost savings and reliability of doppler sonars are discussed.

0214 JOHANSON, E. E. 1976. "Silt Curtains for Dredging Turbidity Control," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 990-1008.

Paper is progress report on study, 'An Analysis of Functional Capabilities and Performance of Silt Curtains,' conducted for U. S. Army Engineer Waterways Experiment Station. Study is conducted in three parts; survey and evaluation of user experience and data, field measurements program to quantify behavior during dredging projects, and assessment of curtain effectiveness based upon first two tasks. Paper presents results of first task and some from second.

0215 __________. 1976. "The Effectiveness of Silt Curtains (Barriers) in Controlling Turbidity," Proceedings, World Dredging Conference, WODCON VII, pp 183-206.

Paper presents results of study conducted for U. S. Army Engineer Waterways Experiment Station to determine effectiveness of silt curtains in controlling turbidity around dredging and disposal operations. Results include definition of conditions under which curtains are effective, optimum deployment techniques, and summary of problems encountered using curtains.

0216 JOHNSON, G. 1975 (Mar). "Dredge Pump Design--A Modern Approach," World Dredging and Marine Construction, Vol 11, No. 4, pp 20-24.

Problems in design and manufacturing of centrifugal pumps in general and dredge pumps in particular are discussed. Heavy duty dredge pump assembly is shown.

0217 JOHNSON, L. E. 1973. "Application of Waterjet Hydraulics to an Underwater Excavation System," Proceedings, World Dredging Conference, WODCON V, pp 685-698.

Expensive oceanographic and fisheries gear frequently cannot be lifted or recovered from ocean bottom because of sediment deposits. Theoretical and laboratory studies leading to a waterjet system for removing sediment over buried equipment are presented. Portable excavation system and field tests are described. Effectiveness of system in retrieving buried crab pots is discussed.

0218 JOY, C. M. 1975. "Hydraulic Power Transmission in Marine Machinery," <u>Marine Engineering Practice,</u> Vol 1, No. 7.

Contents: (i) Principles of hydraulic power transmission; (ii) Hydraulic circuit components - design principles; (iii) Practical hydraulic equipment; (iv) Practical aspects of hydraulic circuits; (v) Typical applications of hydraulic transmission; (vi) Definitions and equations. Examples of hydraulic transmission applied to dredging equipment and dredging craft are given.

K

0219 KADIB, A. A. 1977. "Sedimentation Problems at Offshore Dredged Channels," Proceedings, Fifteenth Coastal Engineering Conference, ASCE, Vol 2, pp 1756-1774.

Paper describes mechanism of sediment deposition and presents simple method for estimating rate of annual maintenance dredging. Effect of submerged breakwater for relieving channel sedimentation is presented.

0220 KADOWAKI, T. 1973 (Sep). "Automated Cutter Suction Dredge Operates Successfully in Japan," World Dredging and Marine Construction, Vol 9, No. 11, pp 18-21.

Computer operation and performance of completely automatic cutter suction dredge are outlined. Automatic swing control system keeps high mud concentration by securing optimum suction load and dredge pump flow.

0221 __________. 1973. "Automatic Operation System of Cutter Suction Dredger," Proceedings, World Dredging Conference, WODCON V, pp 475-494.

Paper describes computer system installed on cutter suction dredge to achieve automated operation. Purposes of computer system are:
(1) maintain peak efficiency regardless of operator skill
(2) cut down labor
(3) improve running economy.

Three systems have been adopted:
(1) auto-control dredge swing system
(2) automatic operation following dredging pattern
(3) automated data treatment and recording while in motion.

0222 KALYANARAMAN, K., GHOSH, D. P., and RAO, A. J. 1973 (Nov). "Characteristics of Sand-Water Slurry in 90 Degree Horizontal Pipe Bends," Journal, Institution of Engineers, India, Vol 54, No. ME2, pp 73-79.

Pressure losses occurring during sand-water slurry flow through 90° horizontal pipe bends were measured experimentally. Measured values of extra pressure losses due to solids were compared with ones calculated by generalized equation derived analytically. Paper gives optimum curvature of bend for minimum pressure loss.

0223 KANAGAWA, K. and KUNINOBU, S. 1973. "New Method of Reclamation on Very Soft Layer," Proceedings, World Dredging Conference, WODCON V, pp 621-650.

Paper describes work done by cutter suction dredgers, where small amount of sand was evenly spread over very soft clay layer.

0224 KATO, H., TAMIYA, S., and MIYAZAWA, T. 1975. "A Study of an Air-Lift Pump for Solid Particles and Its Application to Marine Engineering," Proceedings, Second Symposium on Jet Pumps and Ejectors and Gas Lift Techniques, BHRA, pp G3-37 - G3-49.

Paper treats performance of air-lift pump used to lift solid particles. Flow inside vertical pipe is three-phase, i.e., a mixture of air, water and solid. By coupling flow momentum equation and motion equation of single solid particle, problem can be solved numerically. Computation agrees with experiment where pump head is relatively low. Analysis was made for high head case where air compressibility must be considered.

0225 KAUFMAN, R. and ROTHSTEIN, A. J. 1970. "Recent Developments in Deep Ocean Mining," Preprints, Sixth Annual Conference, Marine Technology Society, Vol 2, Washington, D. C., pp 935-970.

Paper discusses requirements and accomplishments in five areas of deep ocean mining: mine location; bringing ore to surface; winning metal values; meeting marketing requirements; and exclusive use of mine site. Technical journals and patent literature are cited, including proposed deep ocean mining concepts. Material is presented on the air-lift as a viable mining method. Large-scale air-lift pump experiment conducted in flooded mine shaft is described. Principal features of prototype mining test conducted aboard RESEARCH VESSEL DEEPSEA MINER are outlined.

0226 KAZANSKIJ, I. 1973. "Friction Losses and Macroturbulent Intensity in Two-Phase Pipe-Flows," Proceedings, World Dredging Conference, WODCON V, pp 599-619.

Paper is divided into two parts:

1. Experimental verification of several French, Russian and German formulas for friction losses in horizontal circular pipe.
2. New experimental data dealing with change of macroturbulence characteristics. Experiments were made with high concentrations of rigid particles. Damping and intensification of macroturbulence were measured. Intensive creation of macroturbulence (eddies) near critical velocity was observed. Experimental results and empirical formulas are presented. Author's "group-eddy" hypothesis is mentioned.

0227 KAZANSKIJ, I. 1975. "The Field Observation of Some Dredging Parameters," Proceedings, First International Symposium on Dredging Technology, BHRA, pp C4-41 - C4-49.

One of the most important questions in dredging practice is how to predict pipe friction losses and the dredge pump head-discharge curve with changing concentration or solids grain size. Results of full scale investigations are compared with theoretical calculation. Moreover, advantages and disadvantages of field observations and laboratory experiments are compared.

0228 KAZANSKIJ, I. 1976. "Behaviour of Extremely Coarse Particles in Pipe Flow," Proceedings, Hydrotransport 4, BHRA, pp A2-17 - A2-32.

Equations are analysed for calculating friction losses in hydraulic transport of coarse heavy particles. Dominating support mechanism in comparison with sand is discussed. Methods and results of calculating mechanical forces due to coarse particle collision and their rotational and translation velocities are presented. Calculations and observations are compared by motion pictures.

0229 KAZANSKIJ, I. and HINSCH, J. 1974. "The Influence of Changing Pump Characteristics on the Economical Efficiency of the Suction Dredge," Papers, Sixth International Harbour Congress, KVI, pp 2.06/1 - 2.06/4.

Examples are given of changing pump characteristics due to addition of rigid particles. Pump pressure can both increase and decrease with change of solid concentration, depending on grain size of solids and pump construction. Comparison demonstrates consequences of neglecting pump characteristic changes in computating dredge efficiency relative costs of dredge operation.

0230 KAZANSKIJ, I. B., MATHIAS, H. J., and KAHLE, W. 1980. "Some Remarks on Pipe Materials in Connection with Wear Resistance and Dredging Efficiency (Energy Consumption and Critical Velocity)," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 137-162.

Results of pilot plant and field observations on behavior of new pipe materials are presented. Wear resistance of different kinds of pipe materials is discussed. Results of comparing pressure losses in different pipes in connection with energy consumption are also given. Description of new method of measuring critical deposition velocity is provided with results of field tests.

0231 KETELSEN, B. 1968. "Slurry Flow Measurements Using Magnetic Flowmeters," Proceedings, World Dredging Conference, WODCON II, pp 243-254.

Operating principles and design of magnetic flowmeters are described and related to pipeline flow hydraulics. Effects of solid particles on flowmeter operation are discussed.

0232 KHARIN, A. I. 1977. "Classification of Soil in Accordance with the Difficulty of Handling with Hydraulic Dredges," Gidrotekhnicheskoe Stroitel'stvo, Vol 5, pp 51-53.

Author critizes present methods in U.S.S.R. for soil classification in accordance with difficulty of removing it by hydraulic dredge and presents new classification method in tabular form. Soils are divided into seven groups, the water required for removal and transport increasing from 6 m^3 per m^3 for group I (fine and medium particle size

sand) to 15 m^3 per m^3 in group VII (heavy clays and compacted sand and gravel mixtures). Table specifies granulametric composition of soils and removal method required. For group I suction only is necessary, while for groups V to VII, soil must be loosened by mechanical or vibration type methods. Classification is independent of size and power of dredging machinery; therefore, it does not have to be revised as new dredges are developed.

0233 KISS, E. 1978 (Dec). "Narrow Beam Scanning Sonar's Role in Profiling and Positioning," Sea Technology, Vol 19, No. 12, pp 19-20.

Mesotech Systems, Ltd., developed Bottom Scan Profiling Sonar for Marine Drilling, Ltd., in Canada. Model 952 Bottom Scan Profiling Sonar uses high frequency, narrow beam sweeping precisely along line controlled by a microprocessor. Series of profiles taken at different bearings gives 3-dimensional picture of large bottom area without moving from fixed location, allowing measurements to be made directly from dredge without using second vessel to traverse area surveyed. Model 952 features roll compensation, digital memory, and data manipulation.

0234 KNUST, J. 1973. "Analogous Computers to Optimize Hopper Fillings in Hopper Suction Dredgers," Proceedings, World Dredging Conference, WODCON V, p 391-409.

Third revolution of dredging industry is computer-controlled dredge. Partial fulfillment of revolution is development of analog computer to optimize hopper filling. Payloads are optimized, in terms of dredging and travel time, as function of vessel draught, which is proportional to specific gravity of hopper fill. On-board instrumentation and computer system are described.

0235 KNUTSON, P. L. and ENG, D. F. 1974. "A Computer Model for Cost Comparison of Alternative Dredging and Disposal Systems," Proceedings, World Dredging Conference, WODCON VI, pp 295-324.

Computer model was developed to evaluate economic efficiency of present dredging operations and alternative dredging and transport systems. Model was developed as part of Dredge Disposal Study for San Francisco Bay and Estuary conducted by U. S. Army Corps of Engineers. Model contains estimated unit costs for more than 8,000 dredging systems varied with respect to equipment (hopper with and without pumpout, clamshell and hydraulic dredge), transport mode (hopper direct haul, pipeline and transfer facility, tug and barge), and disposal site (Bay, ocean and land).

Model results indicate several theoretical disposal systems may minimize unit costs while complying with rigorous environmental regulations. Model applys to port areas where small and large volumes are generated from a number of sites.

0236 KOESMADI, S. and TIMAH, P. N. 1974. "Some Design Aspects of an Offshore Tin Dredge," Proceedings, World Dredging Conference, WODCON VI, pp 161-176.

An offshore tin dredge incorporates dredging and treatment processes to suit certain deposits to obtain maximum economic return. Less than 20 offshore tin-dredges exist all over the world, mainly in Thailand and Indonesia. Indonesian State Tin Enterprise operates eleven offshore dredges and is planning to build more, which eventually will reach 50 meters digging depth. Problems and experiences encountered by P. N. TIMAH in offshore dredging are presented.

0237 KOHNE, M. 1976. "Investigation of the Dynamic Behaviour of Elastic Pipes for the Hydraulic Lifting of Deep Sea Minerals," Proceedings, Interocean '76, DM, pp 181-196.

Mathematical model is derived for three-dimensional motion of extensible elastic pipes for deep sea minerals hydraulic lifting. Model forms basis for simulation of lateral and vertical pipe motion with respect to ship movements, sea currents or waves. Pipes having lengths 2200 m (for lifting hot brines) and 5000 m (for lifting manganese nodules) are investigated using two different kinds of supports (lower end free or connected with dredge device). Results show lateral and vertical deflections, lateral velocity and bending moment.

0238 KONDO, M., FUJII, K., and SHOJI, H. 1975. "Excavation by Two Phase Water Jets," Proceedings, World Dredging Conference, WODCON VI, pp 565-585.

Article describes experiments on excavation using two phase jets. Flow characteristics were investigated.

0239 KOOIJMAN, J. 1976. "Stress Analyses on Cutters," Ports and Dredging & Oil Report, Vol 90, pp 4-10.

Article explains manner in which stress analyses pertaining to complex structures are carried out. Particular attention is given to cutterhead stress calculations.

0240 KORBEL, K. 1976. "On the Optimization Possibilities of Hydraulic Conveyance of Solids," Archiwum Hydrotechniki, Vol 23, No. 1, pp 35-44.

Minimalization of energy costs for pumping hydromixtures is discussed. Fundamentals of design procedure joining solids delivery concentration with parameters of flow medium and pipe-line are derived.

0241 KORBEL, K., MICHALIK, A., and PRZEWLOCKI, K. 1976. "Determination of the Polyfractional Solids Distribution in a Pipe," Proceedings, Hydrotransport 4, BHRA, pp A4-51 - A4-61.

Investigation method for solid particle distribution in cross-section of straight, circular, horizontal pipe is presented. Polyfractional grain composition and non-homogeneous two-phase fluid behaviour is considered. Authors apply simultaneous measurements of solids concentration distribution by radiometric method and grain size distribution by hydraulic method. Preliminary results show influence of polyfractional solids composition on kinematic behaviour of hydromixtures.

0242 KORZH, V. A. 1975. "Head Losses in Rotational Flow of Pure Water and Sand Slurries," Fluid Mechanics - Soviet Research, Vol 4, No. 5, pp 1-9.

Data on rotational, constant rate flow in straight cylindrical pipes are presented. Equations are obtained for estimating rotation rate and total head losses as function of initial rotation, shape of rotational and translational velocity distributions, and properties of solids. Comparison indicates satisfactory agreement between experimental and theoretical results.

0243 KRAUSE, M. 1978 (Sep). "New Design Dredge Uses Compressed Air for Deep Sand and Gravel Recovery," World Dredging and Marine Construction, Vol 14, No. 9, pp 46-48.

Compressed-air dredge is used for sand and gravel recovery from theoretically unlimited depths. In practice, depths of 100 m have been reached. The dredge works according to air lift principle. Objective of dredge is to convey solids from various depths to comparatively small heights above water. Operation is centrally controlled and designed for 1 person. Dredge can be used for all types of sand and gravel with no performance loss at increased depths.

0244 KRONE, R. B. and ARIATHURAI, R. 1976. "Applications of Predictive Sediment Transport Models," Proceedings, World Dredging Conference, WODCON VII, pp 259-272.

Paper briefly describes new mathematical model of cohesive sediment transport. Example of application to shoaling prediction is given for Savannah Harbor, Ga.

0245 KROTSER, D. J. and EDGERTON, H. E. 1975 (Sep). "Bright Reflections in High-Resolution Seismic Recordings," Proceedings, IEEE Conference on Engineering in the Ocean Environment, IEEE and MTS, pp 315-320.

Seismic systems have been calibrated so that measurements of peak reflection amplitudes could be interpreted, yielding reflection coefficients of -50 to -80% in cases where no deeper penetration was observed. Presumed reduction of acoustic impedance by gas has been confirmed by samples. Improvements to amplitude and polarity display and calibration help interpretation of biologic zones and limits to penetration on seismic profiles.

0246 KRUGER, R. B. 1969. "The State of International Law as Applied to Ocean Mining and an Examination of the Offshore Mining Laws of Selected Nations," Preprints, Offshore Technology Conference, pp I-333 - I-373.

Paper treats subject matter at length. Major subdivisions in paper are: 1) Continental Shelf Regime - Introduction, Truman Proclamation, Convention on Continental Shelf, Provisions of Convention; 2) Effects of Convention on Continental Shelf - claims and practice of U. S., present interpretations, policy regarding shelf and lands beyond; 3) Future Developments - Introduction, Continental Shelf, Area Beyond Continental Shelf, Conclusions; 4) National Offshore Mining Laws (U. S.); 5) Foreign Offshore Mining Laws - Introduction, Argentina, Australia, Bahamas, Brazil, Chile, Fiji, India, Indonesia, Japan, Mexico, Micronesia, Peru, Philippines, Thailand, South Africa, Venezuela.

0247 KURISU, Y. and TANAKA, R. 1976. "Rock Dredging by Cutter Suction Dredgers," Proceedings, World Dredging Conference, WODCON VII, pp 919-946.

Paper describes construction achievements under specialized conditions, such as foundation rock dredging by cutter suction dredger for bridge piers at a strait with swift tidal currents. Rock dredging projects are described by types of rocks encountered and dredgers used.

0248 KYLING, I. C. 1971. "Is a Bad Contract Really Necessary?," Proceedings, World Dredging Conference, WODCON IV, pp 93-108.

Paper shows certain common denominators found in "underperforming" contracts; also in "underperforming" companies.

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0249 LAGASSE, P. F. 1975. Interaction of River Hydraulics and Morphology with Riverine Dredging Operations, Ph. D. Dissertation, Colorado State University, Fort Collins, Colo.

Objectives of study are to determine interaction of riverine dredging operations with morphology and hydraulics of a river system; examine current open water disposal practices in relation to river morphology; and investigate feasibility of disposing dredged material in main channel region. In primary study area, the Mississippi River above Cairo, Illinois, construction of contraction works and navigation dams has taken place concurrently with dredging. Each simultaneously affected water and sediment transport characteristics of river. Study establishes, first, morphology of the natural river, then combined effects of development activities, and, finally, response of the system to dredging and disposal operations.

0250 __________. 1976. "A Geometric Analysis of Riverine Dredging Problems," Proceedings, World Dredging Conference, WODCON VII, pp 1017-1046.

Paper provides geomorphic analysis of riverine dredging problems for one hundred mile reach of Upper Mississippi River between Hannibal and St. Louis, Missouri. Dredging requirements and problem areas are related to geomorphic factors of an alluvial river system. Methodology for applying geomorphic indicators of riverine dredging problem areas is developed and illustrated with case study. Analysis of geomorphic response of river to dredging provides engineer with means of solving problems related to navigation channel maintenance.

0251 LAGASSE, P. F. and SIMONS, D. B. 1976. "Impact of Dredging on River System Morphology," Proceedings, Rivers '76, ACSE, Vol 1, pp 434-438.

Although dredging operations in the riverine environment are generally maintenance oriented, the dredge also provides a means of rapidly altering channel configuration and accelerating morphologic processes in support of river development programs. In this regard, dredging can be considered a morphologic agent responsive to engineering requirements. In the same context, dredges used to obtain materials from the river for construction and related uses can seriously impact morphology and stability by removing coarser sediments. Although adverse impacts of gravel mining have been observed primarily on the Lower Mississippi, projected increases in use of sand and gravel resources in the Upper Mississippi suggest that gravel mining will eventually impact upper river morphology. Combined use of dredging, dikes, and disposal of dredged material in dike fields can induce major changes in river cross-sectional characteristics. Lateral redistribution of sediment by dredging combined with contraction works interrupts natural downstream movement of contact-load sediments, affects local channel morphology and indirectly retards movement of bed load through the system.

0252 LAURENT, P., NARD, G., and MANTEAUX, B. 1974. "Syledis: A New Concept for a Radiopositioning System," Preprints, Offshore Technology Conference, Vol 1, pp 683-687.

Syledis gathers advantages of pulse and phase comparison techniques without usual limitations. It can operate day and night, as a range and/or hyperbolic system, has no ambiguity, and moderate obstacles do not reduce range. System is transportable and operates unattended. Metric accuracy and range make it relevant to hydrography, sounding and dredging, harbor works, pipe laying, oil exploration, platform positioning, ship sea trials, buoy surveying, and pollution investigation.

0253 LECOURT, E. J., JR., and WILLIAMS, D. W. 1971. "Deep Ocean Mining - New Application for Oil Field and Marine Equipment," Preprints, Offshore Technology Conference, pp I-859 - I-866.

Paper describes operational techniques and equipment used in R/V DEEPSEA MINER. Nearly all shipboard equipment was originally developed for marine or oil industry. Major components are described in paper. References and illustrations include: (1) ship, (2) dredge pipe, (3) pipe handling equipment, (4) pumping system, and (5) instrumentation.

0254 LEE, MICHAEL G. 1973 (Sep). "Computer Applications for Dredging," World Dredging and Marine Construction, Vol 9, No. 11, pp 38-40.

Paragon Electronics Corporation developed a minicomputer specifically for marine applications. Computer differs from other shipboard installations because it does not use a tape reader and/or teletypewriter. Rather, it relies on a Read-Only-Memory (ROM) system involving silicon integrated circuit.

0255 LEE, W. W. L. 1976. "Systems Analysis in Evaluating the Economics of New and Maintenance Dredging Projects," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 364-397.

Paper deals with relationship between dredging projects, public expenditure theory and project evaluation techniques. First part of paper establishes that dredging is a "public good." Second part reviews array of increasingly more sophisticated techniques for evaluating dredging projects so that multiple societal objectives, nonlinear values and opinions of many can be dealt with in one project evaluation procedure.

0256 ________. 1980. "Decision Analysis as a Method of Conflict Resolution in Marine Mining," Proceedings, World Dredging Conference, WODCON IX, pp 33-46.

Decision analysis was tested as a method of selecting sites and permitting for sand and gravel mining off U. S. northeastern coast. A series of alternative projects, such as estuarine mining, bay mining and open ocean mining, was considered. Preferences of 17 people knowledgable about marine mining were used to rank alternatives. Paper presents summary of techniques, results and conclusions of this experimental application.

0257 LEININGER, D., ERDMANN, W., and KOHLING, R. 1978. "Dewatering of Hydraulically Delivered Coal," Proceedings, Hydrotransport 5, BHRA, pp E7-103 - E7-116.

Survey is given of quality demands of coal products for hydraulic transport. Criteria for design of dewatering stations are described. Three systems are differed:

- Transport of solid coal to dumping sites and dewatering by sedimentation,
- Moving process point "dewatering" from washery to end of pipeline,
- Setting of "pumpable size" and dewatering in specially designed stations.

Process flowsheets are developed and model calculations made for four defined sizes. Influence of final water contents on design of dewatering plant and cost are presented.

0258 LESPINE, E. 1975. "Employment of Trailing Suction Hopper Dredgers in the Gironde," Terra et Aqua, Vol 8, No. 9, pp 2-11.

Article describes dredging operation in Gironde estuary in France. Hydraulic models of river mouth and Garonne river were used to determine characteristics of navigable channel. Complete study of factors influencing maintenance dredging efficiency was made. Main navigation channel was deepened. Trailing suction hopper dredgers were used, including one commissioned in 1973.

0259 LINSSEN, J. G. T. 1975. "The Performance and the Future Development of Dredging Equipment," Proceedings, First International Symposium on Dredging Technology, BHRA, pp A1-1 - A1-12.

Paper highlights development of dredging equipment in past and future against background of practical human experience and needs of society. History of dredging and dredging equipment needs re-evaluation of source material. There is distinct need for technological progress, but sturdiness and versatility are more important than vulnerable refinements. Greatest need is that society as a whole reaps necessary returns on investments for dredging. Author points out recent developments in miniature and 'life-size' equipment aimed at extending working range and reducing non-working hours caused by adverse weather conditions.

0260 _________. 1977. "Operational Aspects of Dredging Fleets," Proceedings, Seatec '77, UNESCAP.

Author describes operational aspects of dredging fleets, stressing aspects relevant to developing countries. Advantages and disadvantages are stated of carrying out dredging works for public bodies, or having work done by private companies on public tenders.

0261 LINSSEN, J. G. T. and OOSTERBAAN, N. 1975. "Dredging Equipment: Its Past Performance and Future Development," Terra et Aqua, Vol 10, pp 2-13.

Paper describes development of dredging equipment and history of dredging. Author indicates need for technological progress in equipment design, allowing for sturdiness and versatility, and for necessary returns to be obtained on society's investments for dredging. Recent developments are pointed out.

0262 LOBANOV, V. A. and JOANKNECHT, L. W. F. 1980. "The Cutting of Soil Under Hydrostatic Pressure," Proceedings, World Dredging Conference, WODCON IX, pp 327-340.

Formula for cutting force in the direction of cutting velocity (draft angle) is obtained from soil mechanics theory in combination with dynamic conditions. Special attention is given to cohesion, as changes in this characteristic result from effects of hydrostatic pressure and variations in cutting velocity. Angle of internal friction may also be affected by variations in these two parameters. Cutting tests were performed in different materials in a pressurized chamber. Good correlation between calculated draft force and experimental results was obtained.

0263 LOEWY, E., SUMMERS, L., and TRENTER, N. A. 1977. "Site Investigations for Port and Harbour Works," Proceedings, Seatec '77.

Paper outlines ground and marine exploration techniques for port and harbor works, including geophysical and hydrographic surveys, sedimentology, drilling and sampling, and in-situ and laboratory testing. Attention is paid to planning pile loading tests for major marine works together with instrumentation to permit design predictions to be compared with actual performance.

0264 LORENZ, O. K. A. 1967. "Transverse Thrustors and Manoeuvring Aids for Self-Propelled Floating Dredgers," Proceedings, World Dredging Conference, WODCON I, pp 75-89.

Transverse thruster consists of a channel extending from one side of the ship to the other, arranged in the vessel fore body below the waterline. Pump generates strong water current transverse to course direction, assisting conventional steering gear action. Design and characteristics of TORNADO thrusters are described.

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0265 MACDONALD, J. A. 1974 (Jun). "Continuous Earthmoving - 3. Continuous Dredging," Construction Methods and Equipment, Vol 56, No. 6, pp 76-79.

Author describes removal of medium to large quantities of materials using continuous excavating equipment on hydraulic dredge.

0266 MACHEMEHL, J. L. 1975. "Use of Aerial Remote Sensors to Monitor Dredging Projects," Proceedings, Seventh Dredging Seminar, Texas A&M University Center for Dredging Studies, pp 24-28.

Author reviews aerial remote sensors to obtain data in following categories:- 1) coastal zone, - coastline/shoreline/interface; terrain/landform/drainage; erosion; resources/vegetation. 2) nearshore or estuarine zone, - wave surfaces; wave patterns (refraction and defraction); water (currents and depth/penetration/bottom topography); sediment patterns; environmental factors (pollution/turbid plumes and thermal anomalies/effluent diffusion). Author concludes aerial remote sensors can prove economically profitable and provide improvements in quality and quantity of data collected for designing, planning and controlling dredging projects.

0267 MACHEMEHL, J. R. 1971. "State Regulation of Dredging Activities," Proceedings, World Dredging Conference, WODCON IV, pp 519-533.

Paper reviews:

1. Need for dredging control program.
2. Methods of administering effective control program.
3. North Carolina Dredge and Fill Permit Law (G.S. 113-229).
4. Enforcement powers of North Carolina Department of Conservation and Development.
5. Interagency Review Board.

0268 MAKHARADZE, L. I. 1972. "Influence of the Specific Wear of the Impellers of Centrifugal Slurry Pumps on the Operating Regime," Mining Electro-Mechanics and Mine Aerology, Metsniereba Tbilisi, U.S.S.R., pp 56-60.

During operation of hydraulic transport systems, centrifugal pump characteristics and pipeline resistance change on account of wear. This can lead to appreciable alteration in operating regime from that of design. Authors point out that pump wear is more significant than pipeline wear, particularly when head is high. Paper gives mathematical analysis of effect on pump delivery and formula is deduced for calculating slurry delivery change in accordance with pump impeller wear. Author states validity has been confirmed by laboratory tests. Paper does not give quantitative data.

0269 MARAZZO, J. 1976 (May). "New Equipment Boosts Sand, Gravel Production," World Dredging and Marine Construction, Vol 12, No. 6, pp 18-20.

Author describes benefits obtained using metering system to monitor and control dredge flow. Submersible pump, drive unit, and underwater wheel excavator is also discussed which provides constant rate of feed and maximises slurry solids percentage.

0270 MARDESICH, J. A. 1971. "The Design and Construction of an Underwater Dredge," Proceedings, Earthmoving Industry Conference, SAE, Paper No. 710522.

Underwater dredge consists of machinery compartment, pump, operator's compartment, ladder, and cutterhead mounted on Caterpillar tractor undercarriage. Tracks provide mobility to negotiate coral reefs, and also support and flotation. Dredge is replenishing eroded beach by pumping offshore sand deposits ashore.

0271 MARIAN, J. M. 1974 (Sep). "Scheldt River Dredging - A Fight Against Sanding," World Dredging and Marine Construction, Vol 10, No. 10, pp 22-26.

Maintenance dredging works are described. Trailing hopper dredges gave better results than stationary dredges.

0272 MARSHALL, A. G. 1975 (Dec). "Accurate Measurements Save Time, Money, Effort," World Dredging and Marine Construction, Vol 11, No. 13, pp 18-20.

Electronic equipment for speed, depth and position control of suction dredges is described. Tellurometer MRB 201 position fixing system is discussed.

0273 MASSOGLIA, M. F. 1977. Dredging in Estuaries: A Guide for Review of Environmental Impact Statements, Symposium/Workshop Proceedings, National Science Foundation, Washington, D. C.

Guidelines provide methodology to ensure quality of data contained in Environmental Impact Statement (EIS) is adequate to comply with National Environmental Policy Act of 1969 (NEPA). Methodology presented specifies quality of data necessary to assess chronic environmental impacts of estuary dredging.

0274 MASUDA, Y. and GAUTHIER, M. A. 1975. "Development of Continuous Line Bucket (CLB) System and Future of Deep Sea Mining," Preprints, Third International Ocean Development Conference, pp 309-319.

System proposed using air lift pump for deep sea nodule recovery. Continuous Line Bucket (CLB) system also discussed.

0275 MASUDA, Y., CRUICKSHANK, M. J., and MERO, J. L. 1971. "Continuous Bucket-Line Dredging at 12,000 Feet," Preprints, Offshore Technology Conference, pp 837-858.

Continuous bucket-line dredging system was tested at depths of 1080, 3755, and 1220 meters. System is designed to recover manganese nodules and tests verified feasibility. Discussion of merits of continuous bucket-line compared to other continuous systems is made.

0276 MAURIELLO, L. J. 1966 (Oct). "Rehabilitation of Beaches with the Hopper Dredge," Shore and Beach, Vol 34, No. 2, pp 18-20.

Feasibility of hopper dredges equipped to unload and pump sand ashore while moored offshore was studied and reported.

0277 ________. 1967. "Experimental Use of a Self-Unloading Hopper Dredge for Rehabilitation of an Ocean Beach," Proceedings, World Dredging Conference, WODCON I, pp 367-395.

Feasibility of employing Corps-owned hopper dredges equipped to pump sand ashore directly from hoppers while moored offshore was studied. Plant, equipment used, operational experience, and results obtained are described and discussed.

0278 ________. 1968 (May). "Beach Rehabilitation by Hopper Dredge," Journal, Waterways and Harbors Division, ASCE, Vol 94, No. WW2, pp 175-188.

Experiment conducted to determine feasibility of rehabilitating ocean beaches by hopper dredges is described. Plant, equipment used, operational experience, and results obtained are illustrated and described. Future application of operational technique is indicated.

0279 MAURIELLO, L. J. and CACCESE, L. 1963. "Hopper Dredge Disposal Techniques and Related Developments in Design and Operation," Proceedings, Federal Inter-Agency Sedimentation Conference, Miscellaneous Publication No. 970, U. S. Department of Agriculture, pp 598-613.

Conventional methods of hopper dredge operations are described. Disposal techniques and related modifications in design and operation are discussed.

0280 MCDONALD, G. C. R. and WONG, K. T. 1978. "Exploration and Development of a Shallow Coastal Tin Deposit by Suction Dredging at Takuapa, West Thailand," Transactions, Institute of Mining and Metallurgy, Vol 87, pp A29-A38.

Exploration of offshore concession revealed presence of shallow tin deposit. Article describes how initial evaluation of deposit was later corrected and how low mining efficiency of side-trailing suction-type dredge was improved. Both reevaluation and modifications to processing plant have resulted in increased throughput and production.

0281 MCKAY, C. E. 1976. "Comparative Characteristics of Hydraulic and Bucket-Ladder Dredges," Proceedings, Placer Exploration and Mining Short Course, Nevada University, Reno, Nev.

Author presents comparative characteristics of hydraulic cutterhead and bucket-ladder dredges.

0282 _________. 1976. "Some New Concepts in Dredge Design," Proceedings, Placer Exploration and Mining Short Course, Nevada University, Reno, Nev.

New ideas in form of articles and patent applications to provide for deeper digging hydraulic and bucket ladder dredges, and sea swell compensating systems for these two types of dredges are discussed.

0283 MCMANUS, H. P. 1967. "Reclamation Dredging," Proceedings, World Dredging Conference, WODCON I, pp 339-354.

Paper discusses problems of complete reclamation system as matched entity comprising suction system, pump and discharge system. Summary of currently-established theory substantiated by full-scale tests and checks presented.

0284 _________. 1968. "Site Testing of Dredging Equipment and Operational Research," Proceedings, World Dredging Conference, WODCON II, pp 399-448.

Paper suggests methods for field testing pumps, pipeline resistance, etc. Section included on operational research. Emphasis on instructing young engineers.

0285 _________. 1975 (Jul). "Automatic Dredging Controls Designed for Hopper Dredges," World Dredging and Marine Construction, Vol 11, No. 8, pp 24-26.

Automatic operation of side trailing pipes and automatic loading of hopper dredge are described. Features include upclamping pipe safety locks, unlatching gantries at correct time and operation at appropriate winch speed. System also includes capability to hold pipe horizontal at "trunnion down" position and to start dredge pump and run it at predetermined speed with overboard discharge valve open.

0286 MEZHENIN, Y. M. 1975. "An Electro-Hydraulic Method of Clearing the Slurry Intake of a Suction Dredge," Gidrotekhnicheskoe Stroitel'stvo, Vol 8, pp 45-46.

Author describes method of clearing hydraulic suction dredge slurry intake. Electric discharges are applied to intake, effect being to generate jets and water pressure waves of 300 to 600 atm. These loosen stones, timber and other debris caught on screens. Some test results are tabulated. Paper incorporates diagram of equipment together with electrical wiring diagram.

0287 MICHEL, J. F. 1967. "Offshore Dredging - Challenge of the Future," The Society of Naval Architects and Marine Engineers, Southeast Section Symposium, Paper No. 4.

Economical exploitation of offshore sediment sources requires new concepts in systems and hardware. Author discusses possible concepts.

0288 MIYAMOTO, K. and ITO, A. "A Study of Bucket Pin," Proceedings, World Dredging Conference, WODCON IX, pp 633-644.

Studies and experiments have been carried out to provide following:

1) select most suitable pair of metals as pin and bushing,
2) describe wear phenomena due to sand in slide faces,
3) predict life of bucket pin.

0289 MODESTI, C. 1974 (Sep). "Dustpan Dredge Works on River's Shifting Bed," World Dredging and Marine Construction, Vol 10, No. 10, pp 40-41.

Dustpan dredge, Fratelli Rosselli, is described. The dredge is 36 m in length, 8.60 m in width, and 1.60 m in draft. Power on board includes 1800 hp total, 850 hp for pumps, and 520 hp for propulsion. The discharge pipeline is 356 mm. Principal features are outlined.

0290 MOHR, A. W. 1974 (May). "Development and Future of Dredging," Journal, Waterways, Harbors, and Coastal Engineering Division, ASCE, Vol 100, No. WW2, pp 69-83.

Paper describes dredging tools. Paper concludes dredge specialization and pollution constraints require careful selection for ecologically acceptable economical operation.

0291 __________. 1975. "Beach Nourishment with Sand from the Sea," Proceedings, World Dredging Conference, WODCON VI, pp 229-247.

Modern hopper dredge with pumpout capability is available tool to achieve beach replenishment operations. Plant is suitable for large scale long duration assignments. Paper describes background leading to beach replenishment by hopper dredges and test and evaluation operations performed.

0292 __________. 1975 (Nov). "Energy and Pollution Concerns in Dredging," Journal, Waterways, Harbors, and Coastal Engineering Division, ASCE, Vol 101, No. WW4, pp 405-417.

Report reviews bucket ladder dredge in view of energy conservation and pollution abatement and concludes bucket ladder dredges satisfy these concerns, especially at long transport distances.

0293 __________. 1976. "Mechanical Dredges," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 125-138.

Paper compares mechanical with hydraulic dredges for channel excavation. Particular emphasis is on endless chain bucket, or ladder dredges.

0294 MOHR, A. W. 1980. "A Practical Method for Estimating Pipeline Dredge Production," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 79-88.

Method designed to enable dredge managers, supervisors, and operators to estimate pipeline dredge production. Method avoids complicated mathematics and is essentially empirical. Result is anticipated hourly production in terms of in-place material removed.

0295 MOORE, W. L. 1959 (Mar). "Relationships Between Pipe Resistance Formulae," Journal, Hydraulics Division, ASCE, Vol 85, No. HY3, pp 25-41.

Relationship between pipe resistance concepts and empirical formulas is clarified. Procedure developed to derive formula applicable to known flow conditions. Limitations of equivalent pipe concept discussed.

0296 MORIKAWA, H. and OOTA, M. 1975. "Application of Anti-Fouling Device to Pump Dredger," Proceedings, World Dredging Conference, WODCON VI, pp 211-227.

Paper contains results obtained when MGPS (Marine Growth Preventing System) was installed on sea water lines of pump dredger. Author considers system to be effective anti-fouling device.

0297 MORIYA, H. and IKEDA, K. 1975. "Development and Undersea Test of Underwater Trencher (UT)," Proceedings, Third International Ocean Development Conference, Vol 2, pp 381-399.

Underwater trencher was developed for excavating trenches, dredging deep sea bottom and excavating plane foundations for undersea construction. All components were specifically developed for deep sea use.

0298 MORRISON, J. C. 1975. "Some Abrasion-Resistant Alloys for Pumps and Other Services," Proceedings, First International Symposium on Dredging Technology, BHRA, pp G2-19 - G2-34.

Paper discusses material groups used for abrasion resistant parts in pumps. Properties and possible advantages and disadvantages are discussed.

0299 MOTYKA, J. M. and WILLIS, D. H. 1974. "The Effect of Wave Refraction over Dredge Holes," Proceedings, Fourteenth Coastal Engineering Conference, ASCE, Vol 1, pp 615-625.

Study results are presented of beach erosion caused by wave refraction over offshore dredged holes. Mathematical model is used of idealised beach. Beach erosion increased with increasing hole depth and with decreasing original water depth. Effects of side slope and hole

depth will be separated in future work, as will effects of hole shape. Beach erosion due to holes in water depths greater than half the length of "normal" waves, or a fifth of the length of extreme waves, was negligible.

0300 MUDDE, E. and VISSER, T. 1979 (Apr). "Mechanical Face Seal for a High Pressure Dredging Pump," Systems Technology, No. 151, pp 180-186.

Requirements on dredge pumps used for excavation and removal of solids are reviewed. Guidelines on seal design for dredge pumps are given.

0301 _________. 1980. "A New Type of Rotating Seal," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 115-128.

New rotating seal consists of controlled reduction of pressure in seal and continuous lubrication and cooling cf running surface by pumped medium. Application as flushing water seal on suction side of dredge-pumps is discussed.

Tribotechnical behavior and elasto-hydrodynamic lubrication are examined. Test measurements produced data on leakage behavior, friction coefficient, and power absorption of seal.

0302 MURDEN, W. R. 1971. "On-Board Sewage Treatment Systems," Proceedings, World Dredging Conference, WODCON IV, pp 429-455.

Paper reviews installation, testing and evaluation of sewage treatment systems on floating plant. Paper outlines evolution of sewage treatment systems for marine use and summarizes Corps of Engineers plans for installation of total retention type units on all Corps vessels operated on Great Lakes. Corps plans for future testing and evaluation of marine sewage treatment devices and tabulation of new concepts are presented.

0303 _________. 1975. "Sidecasting in Ocean Inlets," Proceedings, World Drcdging Conference, WODCON VI, pp 139-151.

Author discusses need for equipment and techniques suitable for maintaining navigable depths through inlets. Shallow draft sidecasting dredge is described. Loading of split-hull hopper barge with sidecasting dredge is discussed.

0304 MURDEN, W. R. 1978. "The Development of New Dredging Procedures," Thesis, Heed University, Hollywood, Fla.

Report describes and evaluates three field tests conducted to determine feasibility of using hopper dredges to obtain materials from offshore zone for delivery to eroded beaches. Tests focused on capabilities of dredging equipment, including equipment systems used to deliver dredged material to beach areas, and on operation practices employed in dredging and delivery. Report includes recommendations for

further testing of alternative systems including components such as mooring buoys, flexible connectors and discharge pipelines.

0305 MURDEN, W. R. and DONOVAN, R. E. 1971 (Jun). "Nuclear-Powered Dredge for the 70's," World Dredging and Marine Construction, Vol 7, No. 7, pp 19-24.

Nuclear powered cutterhead pipeline dredge design is proposed. Emphasis is placed on maritime nuclear experience and engineering state-of-the-art.

0306 MURDEN, W. R. and GOODIER, J. L. 1976. "The National Dredging Study," Proceedings, World Dredging Conference, WODCON VII, pp 667-700.

Paper defines engineering and economic deficiencies of U. S. dredging fleet, and provides specific details on equipment requirements to develop increased capabilities.

0307 MURDEN, W. R. ET AL. 1976. "Dredging Technologies," Proceedings, World Dredging Conference, WODCON VII.

Papers presented on following topics: engineering aspects of operation and maintenance of Gulf Intercoastal Waterway in Texas; new approach to dredger insurance; dredging of high density sludge using oozer pumps; spatial nonhomogeneity of dredged materials in confined disposal areas; regeneration of tidal dunes after dredging; assessing hydraulic dredging costs and operations; rock dredging by cutter suction dredgers; improved dredge pump liner combining rubber with embedded steel mesh; geometric analysis of riverine dredging problems; and effect of maintenance dredging on sedimentation in Mobile Bay, Ala.

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0308 NAGEL, H. H. 1974. "Reclamation of Spoil with Hopper Suction Dredges," Proceedings, World Dredging Conference, WODCON V, pp 325-345.

Dredging and spoil disposal techniques for West Germany described.

0309 NAGY, A. 1977 (Mar). "Navigation and Positioning Systems Come of Age," Sea Technology, Vol 18, No. 3, pp 11-13.

Article considers ATNAV positioning system which is three-transponder accoustic navigation system using mini computer as core. Shipboard arrangement and applications are described.

0310 NEAL, R. W., HENRY, G., and GREENE, S. H. 1978 (Aug). "Evaluation of the Submerged Discharge of Dredge Material Slurry During Pipeline Dredge Operations," Technical Report D-78-44, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Report describes feasibility of submerged discharge to control turbidity generated when pipeline dredge discharges fine-grained dredged material slurry into open water. Program included survey of field practices, literature survey, analytical investigations, and numerous flume tests. Proposed design incorporates conical diffuser and radial discharge section.

0311 NEERVOORT, F. C. H. 1977 (Mar). "Dredging, a Tool for Port Development, Its Use and Possible Misuse," Proceedings, Seatec '77, UNESCAP.

Article surveys dredging aspects, emphasising Far East. Different dredger types and suitability for various soils and situations are surveyed. Equipment for spoil disposal is included.

0312 NIBLOCK, R. W. 1969 (Jun). "Offshore Mining System Unveiled at OTC Meeting," Undersea Technology, Vol 10, No. 6, pp 22-25.

Details given for operations, cargo handling, and nodule processing of prototype offshore mining system. Elements based entirely on existing technology and include dredge equipment, dredge handling system, shipboard handling and stowage equipment, dredge ship and transport ship--an ore carrier.

0313 NIKOLAEV, A. D. 1972. "Study of Underwater Working of Soil by Cutting," Report No. NTML-WRG-331, National Tillage Machinery Laboratory, Auburn, Ala.

Studies of underwater soil cutting indicate that cutting edge of cutter be rounded and convex downward. Depth of cutting should not exceed .3 times width of bucket.

0314 NISHI, K. 1970. "Suction Booster Pump of Pumping Dredger," Proceedings, World Dredging Conference, WODCON III, pp 331-347.

Dredge has axial flow pump built into ladder suction inner pipe of main pump to prevent suction negative pressure of main pump from rising. Thus, it is free from cavitation and has higher dredging capacity.

0315 _________. 1976. "Dredging of High-Density Sludge Using Oozer Pump," Proceedings, World Dredging Conference, WODCON VII, pp 751-778.

Development of dredging equipment and related techniques integrated into oozer pump dredger is described. Dredger characterized by ease of operation and absence of secondary contamination problems.

0316 NOGUCHI, N., KATO, M., and NIIYAMA, R. 1980. "New Dredging Technique," Proceedings, World Dredging Conference, WODCON IX, pp 367-378.

Dredging technique developed based on concept causing no contamination of sea water.

Authors report the following:

1) Dredging system described disclosing new type of suction mouth.
2) Authors developed suction mouth causing no water contamination and yet shows high performance of dredging at a high concentration of mud.
3) Full scale dredging measurement using actual dredge carried out to demonstrate capability of dredging with less water contamination at high concentration of ooze.
4) Dredging technique capable of increasing dredging efficiency.

0317 NONNER, R., VAN DOOREMALEN, J. J. C. M., and ZIEGLER, R. B. 1974. "Offshore Dredging Systems for Beach Nourishment Projects," Preprints, Offshore Technology Conference, Vol II, pp 269-282.

Paper analizes several dredging systems that can rebuild eroded beaches.

To provide means for selecting dredging system most appropriate for given replenishment project, paper presents calculations of (1) cost per cubic meter of sand deposited on beach, and (2) return on investment in dredging plant.

O

0318 OFUJI, I. 1971. "Deep Dredging by Jet-Ejector Dredger," Proceedings, World Dredging Conference, WODCON IV, pp 249-284.

Construction of five jet-ejector dredges is reported. Dredging device incorporating sand lifting mechanism characterized by ejector and digging mechanism worked by jet water presented.

Main characteristics are:

1. Dredging device digs through silt and clay layer at minimum necessary diameter to reach sand and gravel layer underneath.
2. Excavation of huge volumes of sand and gravel becomes possible.

0319 ________. 1972 (Mar). "Jet-Ejector, More than a Dredge," World Construction, Vol 25, No. 3, pp 11-13.

Sand and gravel excavation at 70 meter depths, harbor deepening, and sand-pile driving with little disturbance of the seabed are handled by five small-to-large jet ejector dredges which mount sand-lifting mechanism characterized by ejector and digging mechanism worked by jet water.

0320 OFUJI, I. and ISHIMATSU, N. 1975 (Nov). "Dredge Overflow System Solves Turbidity Problem," World Dredging and Marine Construction, Vol 11, No. 12, pp 32-36.

Conventional discharge of overflow water from dredging hoppers on board involves release of waste water above waterline into wake of vessel creating considerable turbidity and entrainment of fine silt in water. Hydraulic model tests showed entrainment aggravated by presence of air bubbles in overflow. Modification of discharge chute on trailing hopper suction dredge to allow discharge below waterline substantially eliminated turbidity problem.

0321 ________. 1976. "Anti-turbidity Overflow System for Hopper Dredge," Proceedings, World Dredging Conference, WODCON VII, pp 207-233.

Authors believe dredge overflow system is indispensable for obtaining highest dredging efficiency and minimizing dredging cost. To prevent turbidity of sea water, Anti-Turbidity Overflow System installed on three dredges. In paper, authors describe development process, turbidity mechanism, Anti-Turbidity Overflow System and actual dredging test results.

0322 OFUJI, I. and KATOH, M. 1974 (Dec). "Design Standard Studies for Cutter Suction Dredges," World Dredging and Marine Construction, Vol 10, No. 4, pp 64-69.

Committee organized to establish design standards. Technical studies conducted on stability, freeboard, hull strength and hull fitting of non self-propelled cutter suction dredges. Dredge stability, hull structure and strength discussed in paper.

0323 OFUJI, I. and KATOH, M. 1975. "Studies on Design Standards for Safety of Cutter Suction Dredge," Proceedings, World Dredging Conference, WODCON VI, pp 505-543.

Trend is cutter suction dredger being employed under harsh conditions. Technical studies conducted on dredger stability, freeboard, hull strength and hull fittings. Major studies conducted as follows: (i) Model tests to ascertain characteristics of motion both in still water and regular waves. (ii) Longitudinal and transverse strengths of hull structure analysed by electronic data processor, and system of strength calculation devised.

0324 OKAYAMA, Y. and HAMADA, K. 1980 (Mar). "A Study on the Drag Head Applied for Ooze," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 421-436.

Trailing hopper dredger considered suitable working vessel in broad-wide-pattern dredging for sea bottom ooze.

In paper, authors describe influence of drag head and rotor type, and bed material condition. Operating methods discussed of dredging without short-absorbed materials.

0325 O'NEILL, P. H. 1971. "International Dredge Mining," Proceedings, World Dredging Conference, WODCON IV, New Orleans, pp 11-18.

Topics covered are environmental problems, need to dredge greater depths, and political problems.

0326 __________. 1977 (Feb). "Placer Mining with Bucket Ladder Dredgers," World Dredging and Marine Construction, Vol 13, No. 3, pp 17-21.

Bucket ladder dredge use to recover gold has increased steadily. Author discusses suitability of different dredge designs and bucket capacities for different operating conditions. Author reviews dredging and restoration of mined land.

0327 OOSTERBAAN, N. and BEAN, J. W. 1977. "International Dredging Contract Conditions," Proceedings, Second International Symposium on Dredging Technology, BHRA, Vol 1, pp A2-11 - A2-22.

Author identifies risk elements in most contract forms and stresses importance of enough available data representative for dredge site. He suggests employer, consultant and contractors co-operate to largest extent possible and eliminate all sources of misunderstandings systematically. Some existing escalation clauses for most important cost factors are described. Authors suggest elimination of institutional and legal elements which curtail international competition and obstruct flow of knowledge and expertise between nations.

AD-A137 462 DREDGING: AN ANNOTATED BIBLIOGRAPHY ON OPERATIONS EQUIPMENT AND PROCESSES REVISION(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS HYDRAULICS LAB MAR 82 WES/HL-82-7

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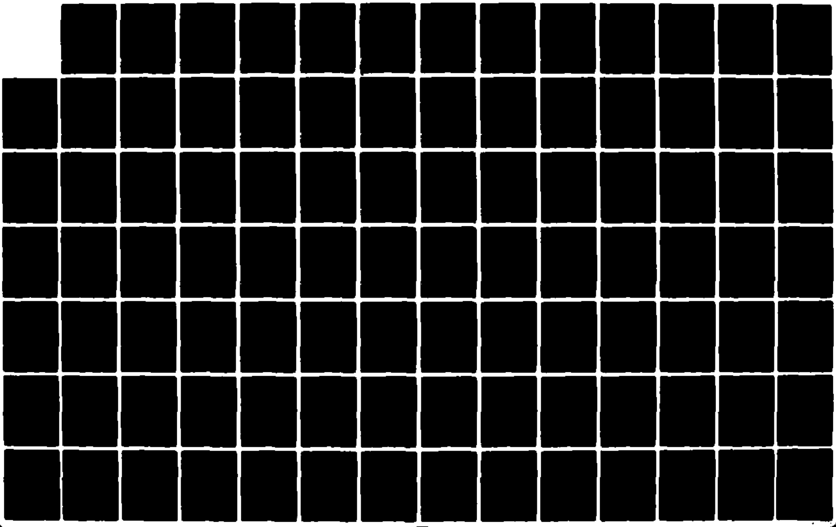

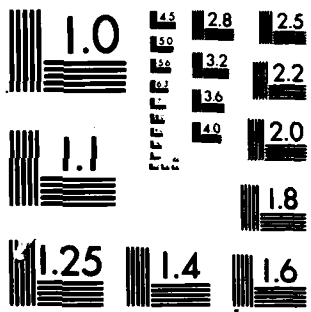

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

0328 OULES, J. P. 1980. "Review of the Attainments Concerning Solids Hydraulic Conveying and the Dredging Industry," Proceedings, World Dredging Conference, WODCON IX, pp 355-366.

Aspects of hydraulic conveying of solids in vertical and horizontal pipe lines which influence such transport are recalled: settling velocity of high volumetric concentration mixtures, fluidization, flow with moving bed, and pseudo homogeneous versus heterogeneous slurries.

Existing models suggest remarks in relation with clear water pressure-gradient in steel pipes, flow of high concentration slurries including fine particles, transportation of gravel or cobble, and pressure gradient in vertical flow.

Influence of practical dredging conditions on transport parameters are examined as well as ways and means to decrease impact of dredging process variations.

P

0329 PARKER, W. R. and KIRBY, R. 1977. "Fine Sediment Studies Relevant to Dredging Practice and Control," Proceedings, Second International Symposium on Dredging Technology, BHRA, Vol 1, pp B2-15 - B2-26.

Definition problems of sea bed become acute in areas where results of echosounding surveys are important for navigational purposes and specification and control of dredging operations. Techniques for measuring in situ density are essential supplements to echosounders.

0330 PARKER, W. R., SILLS, G. C., and PASKE, R. E. A. 1975. "In Situ Nuclear Density Measurements in Dredging Practice and Control," Proceedings, First International Symposium on Dredging Technology, BHRA, pp B3-25 - B3-42.

Dredging practice and efficiency are influenced by sea-bed density. In situ measurements of spoil density should be used in planning capital dredging programs, guiding and monitoring maintenance dredging and in quantifying descriptions of sea-bed altitude. Differing requirements of spatial sampling and accuracy can be satisfied by two types of nuclear densimeter, backscatter probe or transmission probe. Recommendations made concerning applications of each probe, interpretation of density structures and deployment criteria.

0331 PATRICK, C. 1975. "The Estimation of Dredging Need," Proceedings, First International Symposium on Dredging Technology, BHRA, pp A4-49 - A4-62.

Method for estimating need for dredging, and possible side effects, in little known estuaries and shallow marine areas is described. Concepts of sedimentological model and sediment budget are described and used to establish changes in sediment stored within area. Methods and procedures suitable for establishing numerical values of parameters employed in sediment budget equations are recommended. Data requirements and availability reviewed.

0332 PAYTON, L. and BRAUCHT, T. 1973 (Oct). "Reconstructed Pumps Lower Costs," World Dredging and Marine Construction, Vol 9, No. 12, pp 21-23.

Problem of replacing dredge pump shells for cutter suction dredges is reviewed. System developed which has substantially higher alloy content than previously used.

0333 PEARCE, W. B. 1976. "Analysis of Dredging Projects," Proceedings of the Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 139-162.

Paper discusses variables to consider in analyzing dredging projects. Topics considered are: reviewing plans and specifications, field investigation, dredge records, cost records, legal problems, scheduling, and others.

0334 PEKOR, C. B. 1975 (Mar). "Dredge Pump Isn't a Water Pump," World Construction, Vol 25, No. 3, pp 23-25.

Assumptions about efficiency, recirculation and internal geometry are discussed. It is shown that peak production of dredging operation occurs at point narrowly defined by pump speed, flow rate and total head.

0335 PERRY, R. M. 1978 (Sep). "Australia: Shallow Draft Dredge Built to Maintain Channel Through Bar," World Dredging and Marine Construction, Vol 14, No. 9, pp 32-36.

Shallow draft, twin-screw trailing suction side-casting dredge for ocean bar dredging duties built. Vessel has unusually shallow draft of 1.75 m. Dredging system comprises twin inboard stowing 400-mm trailing suction pipes with swell compensators designed for 1.8 m swell. Dredge proved stable and seaworthy, although somewhat subject to wind effects.

0336 PERRY, R. M. 1978 (Apr). "Design and Construction of a Side-casting Dredge for the Victorian Public Works Department," Proceedings, Annual Engineering Conference, Institution of Engineers, Australia, Vol 78, No. 2, pp 298-302.

Paper describes concept, design and construction of very shallow draft, trailing suction sidecasting dredge. Vessel designed to operate on exposed-ocean bars with 1.8 m swell.

0337 PESOCHINSKY, V. N. 1972. "Effective Regimes of Operation of (Multi) Bucket Dredgers," Bulletin, Permanent International Association of Navigation Congresses, Vol 3, No. 13, pp 27-30.

Graphical and analytical methods of defining effective operation regimes are used to determine necessary power of bucket chain drive and operational characteristics of dredges.

0338 PIKE, D. 1977 (Nov). "An Advanced River Survey System," Dock and Harbour Authority, Vol 58, No. 684, p 278.

Port authorities adopt new hydrographic surveying system. System outlined in report.

0339 ________. 1977 (Jul-Aug). "Dredging," Construction News, Vol 25, pp 42-43 and 46-47.

Author identifies five dredging craft and considers characteristics and uses of each. Emphasis placed on increasing use of dredges in civil engineering projects.

0340 PIKE, D. 1979 (Apr). "Dredging Support Craft," Dock and Harbour Authority, Vol 59, No. 701, pp 388-389.

Support craft used in dredging operations fill wide variety of functions, ranging from actual towage or even drydocking of dredger to survey and fuel duties. Various functions of hopper barges, tugs, fuel and water barges, anchor-handling craft, diving support, crew boat, survey craft, maintenance craft, and miscellaneous craft are analyzed.

0341 PITTARD, E. B., GLOVER, J. E., and DAVIS, A. G. 1967. "Comparison Tests on Plain and Rifled Dredge Discharge Pipe," Technical Report No. 2-751, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Field tests compare efficiency of rifled and plain dredge pipe. Test results indicate dredge production with both pipes controlled by suction and output of rifled pipe did not differ significantly from plain pipe for normal lengths used by dustpan dredges. Rifled pipe had substantially greater output than plain pipe for lengths exceeding 1100 ft.

0342 PLACKETT, M. J. 1979 (Nov). "Hovercraft Technology Ready for Dredging Applications," World Dredging and Marine Construction, Vol 15, No. 11, pp 25-29.

Refinement and improvement in hovercraft concepts for dredging operations are discussed. Air cushion principle is explained.

0343 POGODAEV, L. I. and KLIMENKO, V. M. 1973 (Nov-Dec). "Chromium-Manganese Steels for Parts Subject to Impact Wear and Cavitation Erosion," Metal Science and Heat Treatment, Vol 15, No. 11-12, pp 925-928.

Investigation indicates rapidly wearing parts of dredge pumps and other machines operating under similar conditions should be manufactured from pearlitic Cr-Mn steel. For parts operating under severe impact wear conditions it is recommended that steel with 1.0-1.5% Ni be used.

0344 POHLKE, W. 1973. "Gravel Hopper Suction Dredgers," Proceedings, World Dredging Conference, WODCON V, pp 347-368.

Unloading equipment for gravel hopper suction dredges are classified and discussed.

Design features and economy are considered.

0345 POHLKE, W. 1974 (Jun). "Unloading Equipment for Gravel Dredges Examined," World Dredging and Marine Construction, Vol 10, No. 6, pp 26-29.

Paper considers different types of unloading equipment for suction dredges. Continuous and intermittent unloading equipment are examined.

0346 POPPE, C. J. 1976 (May). "'Ezra Sensibar' Completes Major Sand Fill Projects," World Dredging and Marine Construction, Vol 12, No. 6, pp 27-29.

Vessel operates on hopper dredge principle, but differs in propulsion unit. Tug fits in stern notch, is detachable and need not be part of plant when barge is under repairs.

0347 POVKH, I. L. 1976. "Averaged Velocity Profile, and Friction Loss, of the Turbulent Flow of a Water Suspension of Clay," Gidromekhanika, Vol 34, pp 61-65.

Study made of turbulent flow of dispersion systems containing from 2% to 5% bentonite clay powder. Head losses for various clay concentrations given in graph form, and some formulae are deduced.

0348 PROEHL, N. 1976 (Apr). "Proehl Cutterhead Moves Through Rock, Clay, Sand," World Dredging and Marine Construction, Vol 12, No. 5, pp 12-15.

Cutterhead fabricated from steel plate, and dressing of cutting blades altered with cutting torch. Each tooth of cutterhead is held in own socket by single bolt, and formation and spacing between teeth can be altered depending on operating conditions.

0349 PULLERITS, K. 1979. "Hydraulically Driven Cutterhead Airlift Dredge for Deep Water," Proceedings, First Canadian Conference on Marine Geotechnical Engineering, Canadian Geotechnical Society.

Paper discusses design, construction and application of deep water dredge to excavate moderate quantities of granular or cohesive seabed material in deep water. Objective was excavate overburden from inside of steel caissons being installed in seabed for wellhead protection.

R

0350 RICHARDSON, C. 1976 (Dec). "Alaska Dredging: Tough Project Reported," World Dredging and Marine Construction, Vol 12, No. 13, pp 49-54.

Author reports how delay to Trans-Alaska Pipeline construction was avoided when dredge "Biddle" was put into service to remove 1,000,000 cubic yards of pea gravel from channel.

0351 RICHARDSON, T. W. 1976 (Sep). "Beach Nourishment Techniques: Dredging Systems for Beach Nourishment from Offshore Sources," Technical Report H-76-13, Report 1, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Report presents results of first two phases of research project developing new dredging systems for beach nourishment from offshore sources. Report presents results of investigation into equipment suitable for offshore nourishment work. Examples described illustrate dredge types, pipelines, connections, and miscellaneous pieces of equipment. Final portion of report consists of equipment selection subcategories for further consideration and construction of possible offshore nourishment systems using selected equipment. Report includes approximately 45 illustrations and 85 references directly related to offshore dredging and beach nourishment.

0352 RIDDELL, J. F. 1973 (Jun). "Maintenance Dredging - Yield and Efficiency," Dock and Harbour Authority, Vol 54, No. 632, pp 59-63.

Investigation quantifies material dredged from upper reaches of River Clyde within Port of Glasgow. Author shows hopper barges would make maintenance dredging more efficient if designed for material they dredge.

0353 RIDDELL, J. F. 1975. "Dredging Performance, Yield and Efficiency," Proceedings, First International Symposium on Dredging Technology, BHRA, pp B2-15 - B2-24.

Paper describes studies to quantify performance of maintenance dredging plant together with methods adopted to improve plant efficiency. Monitoring of sediment inflow is described as is deposition rate and variation in bed level with time. Existing methods of measuring output of dredging plants and dredgers reviewed.

0354 RIDLEHUBER, L. 1974 (Aug). "Dredges Pump Wet Construction Site Dry," Construction Methods and Equipment, Vol 56, No. 8, pp 58-60.

Author describes two small but powerful dredges which are converting underwater-hydraulic fill site into stable land able to support nuclear reactor assembly plant.

0355 ROBERTS, W. J. 1976 (Dec). "Small Lakes 'Vacuumed' by Dredges," World Dredging and Marine Construction, Vol 12, No. 13, pp 26-27.

Article describes use of small portable dredgers to remove sediment from reservoirs. These have suction heads which operate without creating appreciable turbidity.

0356 ROBINSON, W. S. 1980. "Bottom Assessment and Its Effect on Dredged Quantity Measurement," Proceedings, World Dredging Conference, WODCON IX, pp 701-706.

Pre-dredge surveys in areas overlain by low density sediments contain potential error because of difficulty in defining horizon that represents upper limit of pay quantity. Method of defining horizon, and calibrating echo sounders to respond to it, is proposed.

0357 ROMANIELLO, C. G. 1977 (Nov). "A New Concept in Position Fixing," World Dredging and Marine Construction, Vol 13, No. 12, pp 30-31.

Tellurometer MRD1 microwave position fixing system described. Use reasoned that dredging costs could be reduced if possible to control dredging operation more accurately.

0358 ROTHSTEIN, A. J. 1970 (Sep). "Deep Ocean Nodule Mining," Underwater Science and Technology Journal, Vol 2, No. 3, pp 133-137.

Development program of equipment and engineering systems for deep ocean mining scheduled. Prototype hydraulic dredging system developed incorporating collecting head, pipeline, pumping unit and ship support system. Operational problems of one-mile-deep mining rig solved and prototype expected to begin work.

0359 ROWE, R. P. 1976 (Jul). "Dredging for Beach Restoration," International Dredging and Port Construction, Vol 3, No. 21, Series 2, pp 15-16.

Marine aggregates dredged from sea used to restore beaches.

0360 RUSSELL, I. C. 1978 (Jan). "Dual Channel Sidescan Sonar, Uses and Operation in Hydrographic Surveying," International Hydrographic Review, Vol 55, No. 1, pp 27-99.

Author discusses use and operation of Dual Channel Sidescan Sonar DCS-3 system and emphasises importance of system.

S

0361 SALOMON, G. 1976 (Nov). "Industrial Wear," Lubrication Engineering (ASLE), Vol 32, No. 11, pp 570-571.

Simulation and control of transitions, leading from proper operation to incipient failure of mechanisms considered. Models proposed range from operational analysis to abstraction of electrical analogues. Following categories covered: Control of severe wear in intrinsically open systems, e.g. dredges; Classification of transitions in run-in of marginally lubricated, heavily loaded contraformal contacts; Selection criteria for marginally lubricated conformal contacts; Application of analogue models to tribology of power transmission. Appraisal of future developments attempted.

0362 SALZMANN, H. 1977. "A Laboratory Study of Fluid and Soil Mechanics Processes During Hydraulic Dredging," CDS Report No. 184, Texas A&M University Center for Dredging Studies.

Hydraulic and soil mechanics processes during bottom suction investigated. Method given for determination of solid material output of hydraulic dredge considering soil mechanics and hydraulic, geometric and pump-engineering boundary conditions.

0363 SANDERSON, W. H. 1976. "Sand Bypassing with Split-Hull Self-Propelled Barge Currituck," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 163-172.

Experiments conducted using prototype split-hull, self-propelled barge to receive material excavated by trailing-suction, shallow-draft sidecasting dredge and transport material from navigation channel to point on downdrift beach. Two transporter units handle output of single 12-inch discharge sidecasting dredge and remove dredged material from inlet. Material placed in littoral zone at or near boundary of surf zone.

0364 SARGENT, J. H., GARDNER, R., and CLARK, T. 1975. "Underwater Rock Removal," Report UR6, CIRIA Underwater Engineering Group, U. K.

Report surveys rock dredging technology. Dredgers used for rock dredging described and discussed, as are normal methods of pretreatment.

0365 SATO, E. 1976. "Application of Dredging Techniques for Environmental Problems," Proceedings, World Dredging Conference, WODCON VII, pp 143-162.

Author emphasises importance of research in reducing dredging impact on environment. Dredging turbidity can be minimised with correctly designed cutter suction head. Equipment described for dredging contaminated sediments and wastewater treatment.

0366 SAVEL'EV, A. A. ET AL. 1973. "Use of Gyro Compass as Sensor of Dredge Angular Turns for a Polygon System of Program Control," Izvestiia Vysshikh Uchebnykh Zavedenii. Gornyi Zhurnal, No. 11, pp 128-133.

Comparison of dredge oscillation around piles and of gyro compass. Conclusion drawn that use of gyro compass with dredge is advantageous. In Russian.

0367 SCHLAPAK, B R. and HERBICH, J. B. 1978. "Characteristics of Coral and Coral Dredging," Report No. TAMU-SG-78-207, Texas A&M University Center for Dredging Studies, College Station, Texas.

Study performed for civil engineers involved with coral dredging and use as construction material. Coral discussed and illustrated; engineering properties, excavation data, coral reef formation, and worldwide distribution presented and/or discussed.

0368 SCHMIDT, F. J. 1972 (Jan). "Dustpan Dredge, an American Development," World Dredging and Marine Construction, Vol 8, No. 1, pp 12-17, 19.

Construction and operation of dustpan dredge described. Advantages, evolution of dredge components, and use of dustpan dredge in other countries reported.

0369 __________. 1977 (Apr). "Performance Test of a 20-Inch Cutter Dredge," World Dredging and Marine Construction, Vol 13, No. 5, pp 14-17.

Tests carried out on dredger "Collins" to determine why production was lower than expected. Dredger is described in detail and test equipment is listed. Tests carried out at four engine speeds, and results and conclusions given.

0370 SCHNEIDER, K. 1976 (Apr). "Evolution of Rubber Dredge Hoses," International Dredging and Port Construction, Vol 3, No. 19, pp 29 and 31.

Author traces development in dredger delivery pipes, from 'leather bag,' ball and rotary joint to highly sophisticated rubber hose.

0371 SCHNEIDER, K. ET AL. 1968. "Mistakes at the Use of Dredger Hoses Are Uneconomical," Proceedings, World Dredging Conference, WODCON II, pp 37-55.

Where dredging water and solid mixtures are transported through pipelines, it is essential that such pipings are made flexible, provided with compensators or other types of flexible joints. Requirements met advantageously by providing rubber hoses, if fitted correctly.

0372 SCHOLES, W. A. 1969 (Oct). "World's Largest Rutile Dredge in Action," World Dredging and Marine Construction, Vol 5, No. 9, pp 20-21.

Features of mineral sands dredging complex described.

0373 SCHUSSLER, H. 1978. "Inductive Flow Measurement with Low Frequency Triangular Field," Proceedings, Hydrotransport 5, BHRA, pp G6-73 - G6-86.

Inductive methods for volume measurement applying alternative field or rectangular switched field are compared with method using low-frequency triangular field.

Application of inductive flowmeters within elliptical pipe section proposed.

Characteristic data for control and optimization of transport parameters can be determined with described supplementary units.

0374 SCHWARTZ, H. I. 1975 (Mar). "Jet Boosting in Hydraulic Dredging," Journal, Hydraulics Division, ASCE, Vol 101, No. HY3, pp 590-594.

Jet-pump entrance velocities in dredging head can be increased substantially by extracting water from jacket surrounding pervious portion of head. Water extraction by jet pump may prove superior to conventional in-line boosting.

0375 SCRIVENS, R. F. 1976 (Mar). "Weather Warning System Developed for Dredges," World Dredging and Marine Construction, Vol 12, No. 4, pp 18-20.

Advance warning of deteriorating local weather conditions is provided by semi-portable instrumented buoyed system. System provides water current, wave, tide and wind speed data direct from mooring location to receiver unit on dredge. System also assists dredge operation by presenting water current and depth information.

0376 SHEEHY, G. D. 1975 (Mar). "Submersible Dredge Pump--an Answer for Deep Dredging," World Dredging and Marine Construction, Vol 11, No. 4, pp 25-27.

Author describes submersible dredge pump development used on dredge for excavating pipeline trench. Results are increases in effective vacuum and higher percentage of solids pumped.

0377 __________. 1976 (Oct). "Dredge Pump Maintenance," Pit and Quarry, Vol 69, No. 4, pp 106-109.

Standard dredge pump has four or five parts which contact flow through pump. These parts are case or shell, impeller, suction side liner, bearing side liner, and throat liner, if incorporated. Wear on parts vary, requiring some to be replaced sooner than others. Approximate life of dredge pump wearing parts shown.

0378 SHELOMOV, I. P. 1973. "Comparative Evaluation of Block Diagrams of Dependent Control Systems of the Extraction Complexes of Dredges," Izvestiia Vyssikh Uchebnykh Zavedenii. Gornyi Zhurnal, No. 8, pp 155-160.

Block diagrams of dependent control of scooping and lateral displacement speeds presented. Analysis made of diagrams without additional low-frequency filters. Influence of different block diagrams on productivity of extraction complex of dredge regarding mass of rock evaluated. In Russian.

0379 SHIH, C. C. S. 1964 (Nov). "Hydraulic Transport of Solids in a Sloped Pipe," Journal, Pipeline Division, ASCE, Vol 90, No. PL2, pp 1-14.

Effects of heterogeneously suspended solids in pressure flow of liquid on head losses or energy gradients for various pipe slopes, solid concentrations, and flow rates investigated. Through choice of dimensionless parameters, data analyzed and presented in general form.

0380 SHLEMON, R. 1975. "Dredging Control of Deltaic Sedimentation, Atchafalaya Bay, Louisiana," Proceedings, World Dredging Conference, WODCON VI, pp 249-259.

Paper reviews geology of Atchafalaya Bay, notes anticipated growth rate and form of future Atchafalaya Delta, and suggests approach to build new land by sequentially controlling subdelta formation, yet maintaining existing navigation.

0381 SILVESTER, R. and VONGVISESSOMJAI, S. 1970. "Characteristics of the Jet Pump with Liquids of Different Density," Proceedings, World Dredging Conference, WODCON III, pp 293-315.

Jet-pump has useful application in dredging operations such as generating suction in hydraulic dredgers and booster-pumping of long discharge lines. One major benefit is driving pump need not have coarse sedimentary material passing through it. Curves submitted for clear water case driving a fluid containing various concentrations of sand. Reference made to cavitation limitations.

0382 SIMATUPANG, M. 1978 (May). "Indonesian Offshore Tin Development," World Dredging and Marine Construction, Vol 14, No. 5, pp 34-38.

Shallow seas and coastal areas from southern Malaysia to island of Belitung covered with tin-bearing granite. Output/m^3 lower for offshore dredges than inland dredges. Bucket dredge preferred to cutter since Sn concentrated above bedrock. Dredges can operate in 1.5-m wave. In general, all offshore deposits suitable for dredging.

0383 SINGHAL, D. C. 1978 (Jul). "Equipment Development for Dredging Steelworks Cooling Pond," TISCO, Vol 25, No. 3, pp 83-99.

Article describes features of grab dredger and hopper barge developed for dredging, along with mechanical and structural design.

0384 SLOTTA, L. S. 1973. "Cutterhead Research and Standardization," Proceedings, World Dredging Conference, WODCON V, pp 437-474.

Analytical approaches to dredge cutterhead design reviewed. Approach toward standardizing and limiting design variations in suction dredge cutterheads presented. Research proposed to develop rational approaches toward suction cutterhead design.

0385 __________. 1976. "Side Scan Sonar Views of Channel Disturbances Associated with Marine Traffic and Dredging," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 226-241.

Article describes side scan sonar system used to study sea floor, rivers and estuaries. It utilises dual channel graphic recorder, transducer tow fish, and cables. Applications discussed, including study of harbour at Coos Bay, Oregon.

0386 SLOTTA, L. S., JOANKNECHT, L. W. F., and EMRICH, R. K. 1977 (Dec). "Evaluation of Dredge Cutterhead Production as Affected by Cutter Height," World Dredging and Marine Construction, Vol 13, No. 13, pp 9-19.

Model tests designed to determine best proportions of cutterhead diameter versus height. Authors discuss test equipment and design, processings of signals, materials preparation, consolidated media preparation, test data regarding conglomerate, test design and basis for comparisons, tests in compacted sand and in conglomerate.

0387 __________. 1977. "Influence of Cutterhead Height on Dredge Production," Proceedings, Second International Symposium on Dredging Technology, BHRA, Vol 1, pp D1-1 - D1-20.

Model studies conducted determining effect of cutterhead height on production of dredged materials. Results indicated short cutter gave best reproduction and production rate per kW.

0388 SMITH, A. B. 1963. "Channel Sedimentation and Dredging Problems, Mississippi River and Louisiana Gulf Coast Access Channels," Proceedings, Federal Inter-Agency Sedimentation Conference, USDA, pp 618-626.

Channel shoaling in Mississippi River between Cairo, Ill., and New Orleans, La., has been major navigation problem since 1870. Solution to Passes problem, where salt-water wedge and Mississippi River sediment meet, resolved by combination of jetties, contraction works, and dredging. Annual channel shoaling on crossings between Cairo, Ill., and Baton Rouge, La., battled by dustpan dredge since development in 1895. Today, problem combated by channel stabilization works and dredging.

Silting in Atchafalaya River, including basin, lake section, and Gulf access channel below Morgan City, attacked by major dredging program. Channel silting in Calcasieu River ship channel met by new construction dredging, including retention dikes, enlargement of existing waterway, and maintenance dredging.

0389 SMITH, C. A., JR. 1974 (Jun). "Small Class Clamshell Dredge Works on Big Class Projects," World Dredging and Marine Construction, Vol 10, No. 6, pp 36-39.

Small grab dredge capable of big dredging job developed. Author describes conversion of dipper dredge to clamshell dredge capable of working at 50-foot depths.

0390 SMITH D. D. ET AL. 1976 (Nov). Coastal Dredging," Proceedings, Second Annual Conference, Coastal Society.

Significance of dredging impacts in San Diego Bay area, Tampa Bay estuary, San Pedro Bay, and upper Chesapeake Bay evaluated. Complex procedural mechanisms for regulating contemporary dredging operations reviewed, and major time and cost consequences of regulatory controls considered. Biological enhancement of central Long Island Sound area through containment spoiling discussed.

0391 SMITH, E. E. 1972 (Oct). "Total Concept Approach to Rebuilding Pump Shells," World Dredging and Marine Construction, Vol 8, No. 11, pp 19-21.

Automatic dredge pump welding system devised. System includes power supply, wire drive, nozzle positioning and manipulating device, and specially designed wires for proper rebuilding dredge pump shells. Case histories presented.

0392 SMITH, M. F. 1978. "Materials Handling by Slurry Pipelines," Report No. NTIS/PS-78/0720/9ENS, National Technical Information Service, Springfield, Va.

Bibliography contains citations on pipeline transportation of coal, oil, household wastes, sewage, mining, and dredging slurries. Studies on transport properties, fluid flow, hydraulic systems, pumps, and environmental impacts are included, as are economics and safety of slurry pipeline transportation. Majority of studies energy related.

0393 SNELL, J. R. 1973 (Dec). "Dredging Restores Dying Inland Lakes," World Dredging and Marine Construction, Vol 9, No. 14, pp 30-34.

Dredging work on lakes in Michigan done by discharge dredge described. Operating features of dredge are walking spud, reversible pump, and reversible cutterhead. Dredging limits and spoil areas indicated.

0394 SORENSEN, A. F. 1974. "The Case for Dredge Specification Standards," Proceedings, Sixth Dredging Seminar, Texas A&M University Center for Dredging Studies, pp 59-85.

Author discusses need for dredge specification standards and gives example of specification criteria relating to various components of hydraulic cutterhead type dredges.

0395 SORENSEN, A. H. 1971 (Mar). "Equipment State-of-the-Art, U. S. Dredging Industry," World Dredging and Marine Construction, Vol 7, No. 4, pp 20-21, 24-26.

Arrangement of hydraulic pipeline dredge described. Machine consists of four basic modules. Discussion of machine related to port and harbor works, channels, land fill, and others.

0396 __________. 1976. "Today's Criterion for Designing and Operating a Hydraulic Pipeline Dredge in Underwater Mining," Proceedings, Placer Exploration and Mining Short Course, University of Nevada.

Author states too few builders and operators have begun to make dredge building and dredging a true engineering discipline and he outlines some parameters and concepts that must be dealt with if dredge technology is to achieve same level as other modern technologies. Author discusses mechanical components of hydraulic pipeline dredge and physical factors affecting dredge mining. Operating conditions, basic dredge laws, dredging efficiency and output are considered. Underwater dredge pump, development of excavator (plain suction, cutter suction and bucket wheel dredges) and new trends such as training, simulation, instrumentation and automation are considered.

0397 SPEAR, J. L. 1980. "Claims Under Dredging and Construction Contracts," Proceedings, World Dredging Conference, WODCON IX, pp 19-32.

Claims are inevitable in any major construction or dredging contract. Accordingly, contracts are written to permit contractors to assert claims for additional costs.

Claims arise from variety of sources, such as differing soil and bottom conditions, severe weather, and other unforeseeable causes. Regardless of claim cause, contractor must be vigilant if he is to identify claim promptly and obtain full, accurate payment for work performed.

0398 SPIES, H. R. 1973 (Sep). "Hopper Dredges Use Electronic Devices," World Dredging and Marine Construction, Vol 9, No. 11, pp 22-24.

Measuring system described consists of interrogator unit, which is carried on board vessel and two responder units which are placed on point of known horizontal position. System provides simultaneous measurement of two distances between interrogator and responders. From measurements, dredge position determined.

0399 SPIES, H. R. 1977. "Automated Hydrography in Philadelphia District," Journal, Surveying and Mapping Division, ASCE, Vol 103, No. SU1, pp 7-13.

Completely automated hydrographic surveying and plotting system assembled by Corps of Engineers. Development of system examined from evaluation of earliest electronic positioning equipment to total system now in use. Components of system and their functions described.

0400 STANLEY, D. T. J. 1977. "Integrally Floated Flexible Pipeline for Use with Cutter/Suction Dredgers," Proceedings, Second International Symposium on Dredging Technology, Vol 1, pp J3-35 - J3-46.

Paper details first integral floating flexible pipeline introduced to dredging industry in 1970. It has removed most hazards and difficulties experienced with traditional pontoon supported steel pipeline.

0401 STARRING, J. W. 1971 (Feb). "Sand Fill Pumped 15 Miles for Interstate Construction," Civil Engineering - ASCE, Vol 41, No. 2, pp 44-46.

Interstate 10 constructed through swamps and marshland on embankment in Louisiana. Since lowlying areas along route have unstable surface soils, muck dredged out and replaced with granular material brought by pipeline. 30-in. hydraulic dredge placed in river to recover materials, which were pumped through pipeline system from dredge boat at approximately 125 psi.

0402 STEEL, C. J. 1978. "Sand Suction Dredgers Look to Bright Future," Nautical Review, Vol 2, No. 4, pp 20-22.

Author describes two sand suction dredgers. Significant advances include centralised electronic controls and 3.3 kV electrical system. Proven technology incorporated in modern sand suction dredgers will ensure continued expansion of marine aggregates industry.

0403 STEINKUEHLER, S. 1971 (Oct). "Portable Cutter Suction Dredge Proves Its Versatility," World Construction, Vol 24, No. 10, pp 21-22.

Units with total installed power rating of 1235 hp described. Main diesel drives dredging pump (920 hp) and hydraulic pump for cutterhead (150 hp). Hull consists of five individual and detachable pontoons so that dredge can be disassembled either afloat or ashore and transported overland if necessary.

0404 STEPHENS, H. S. and THORNTON, W. A. (Editors). 1973. Proceedings, Hydrotransport 2: Second International Conference on the Hydraulic Transport of Solids in Pipes, BHRA, Cranfield, Bedford, U. K.

Following is list of papers presented:
Turbulent Diffusion of Heat, Mass and Momentum in Solids Suspensions. Influence of High Concentrated Rigid Particles on Macroturbulence Characteristics in Pipe Flow. Variation of Characteristic Length of the Turbulence in Pipe Flows with Solid Particles in Suspensions. Two-Phase Laminar Boundary Layer Along a Verticle Flat Wall. Unsteady Flow of Suspension of Variable Concentration. Slip-Model Correlation of Dense Two-Phase Flow. Mechanism of Hydraulic Conveying at High Concentration in Vertical and Horizontal Pipes.

0405 STOJANVIC, Z. 1968. "Some Observations on the Development of a Dredging Pump Working Model of Various Impeller Width," Proceedings, World Dredging Conference, WODCON II, pp 1022-1032.

Impeller width of centrifugal dredging pump model reduced on back shroud side. Results of investigation and various methods for recalculation of dredging pump working characteristics when changing impeller width at exit analysed in paper.

0406 STRAJBL, J. 1968. "Development of Automation on Suction Dredges Built in Czechoslovakia," Proceedings, World Dredging Conference, WODCON II, pp 170-192.

Dredger operation processes automated in three independent phases:
(1) Automation of dredger's operation movement control including longitudinal, side, and vertical.
(2) Automation of dredging processes including regulation of slurry density and rope tension on winches.
(3) Automation of protective systems for machine equipment.

0407 STUBER, L. M. 1976. "Agitation Dredging - Savannah Harbor," Proceedings, World Dredging Conference, WODCON VII, pp 337-390.

Slips and wharves located adjacent to Savannah River Channel experience shoaling rates of 0.3 to 3.5 feet per month. Required depths maintained by dragging slips with tug and I-beam or similar device during ebb tide. 1973 records indicated that approximately 450 hours of agitation dredging performed in Savannah Harbor. Water quality monitoring of agitation dredging and alternatives to agitation dredging investigated.

0408 SUMMERS, L. 1975. "Dredging in Alluvial Muds," Proceedings, First International Symposium on Dredging Technology, BHRA, pp E1-1 - E1-12.

To enable shipping to reach ports within estuaries it is often necessary to realign, deepen and stabilize natural channel across bar by dredging. However, in soft, silty muds it is difficult to meet demand for increasing depths and widths of access channels. Correct understanding of nature and condition of such material is necessary to achieve reliable navigation channel. These problems were encountered in study of navigation channel dredging across bar at mouth of River Chao Phraya.

Special methods evolved to obtain information on variation of in situ soil density with depth, using gravity samplers and densimeter with radioactive source. Optimum relationship between in situ density, hopper density of spoil and length of dredging cycle time evolved.

0409 SUSTAR, J. F., WAKEMAN, T. H., and ECKER, R. M. 1976. "Sediment-Water Interaction During Dredging Operations," Proceedings, Speciality Conference on Dredging and Its Environmental Effects, ASCE, pp 736-767.

Dredging and disposal activities inherently cause disturbance and redistribution of bottom sediments. Major element necessary for evaluating environmental impact of dredging or disposal operation is determination of interactions between sediment and water during disturbance and redistribution. Detailed field assessments of sediment-water interaction phenomena during dredging and disposal operations have been neglected. Field studies undertaken to quantify degree and duration of sediment-water interactions at selected dredging and disposal locations in San Francisco Bay. Paper reports results of these field studies.

0410 SWAN, S. and SCHAFFER, L. 1980. "Dredge Safety Hazard Analysis," Proceedings, World Dredging Conference, WODCON IX, pp 125-134.

Work of U. S. Bureau of Mines has included periodic research in mining dredge safety for more than fifty years. Most recent examination of dredge safety hazards reported.

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0411 TAJIB, A. 1975. "Tin Dredging Development in Indonesia," Proceedings, World Dredging Conference, WODCON VI, pp 5-10.

Author describes dredging in Taipei using dredger fleet including bucket dredges. He hopes that dredging industries will adopt more flexible attitude and scientific approach to dredging problems.

0412 TANAKA, R. and KURISU, Y. 1977 (May). "Rock Dredging by Cutter Suction Dredges," World Dredging and Marine Construction, Vol 13, No. 6, pp 22-24.

Subjects discussed are rock dredging for piers, rock topography, method of dredging operation, and results of dredging operation.

0413 TARJAN, I. and DEBRECZENI, E. 1976. "Determination of Hydraulic Transport Velocity for Pumps with Various Characteristics," Proceedings, Hydrotransport 4, BHRA, pp H2-25 - H2-34.

Hydraulic transport requires three characteristic velocities to be determined theoretically as well as experimentally. They are deposit velocity, operating velocity, and so-called economic velocity.

0414 THEINER, I. 1975 (Dec). "A New Method of Dredging," Construction News, Vol 1, No. 11, pp 26, 27, 29, and 31.

Author discusses use and disadvantages of bucket chain dredgers, cutter suction and grab dredgers. Hydraulic excavator mounted on pontoon designed to overcome difficulties developed.

0415 THEINER, J. 1976 (Feb). "Pontoon-Mounted Hydraulic Excavators: a New Method of Dredging," International Dredging and Port Construction, Vol 3, No. 17, pp 27, 29, and 31.

Article compares several types of dredgers with use of hydraulic excavator mounted on spud pontoons. This floating dredger can handle heavy material, or material containing rock and stones.

0416 THORN, M. F. C. 1975. "Loading and Consolidation of Dredged Silt in a Trailer Suction Hopper Dredger," Proceedings, First International Symposium on Dredging Technology, BHRA, pp B1-1 - B1-14.

Detailed experimental study of loading and consolidation of dredged silt carried out in hoppers of trailer suction dredger. Density-depth profile of spoil payload in hoppers measured 'in situ' by Harwell silt density probe. Possible to obtain accurate comparable measurements of spoil accumulated in hopper for various different dredging methods. Experiment showed no increase in spoil load achieved by continuing to dredge beyond time required to fill hoppers to overflow level. Excess dredging with hoppers full resulted in reduction of ultimate hopper load.

0417 THORN, M. F. C. 1976 (Mar). "Silt Consolidation Tested by Harwell Density Probe," World Dredging and Marine Construction, Vol 12, No. 4, pp 29-30.

Article is excerpt from paper on 'Loading and consolidation of dredged silt in a trailer suction hopper dredge' presented at First International Symposium on Dredging Technology, and highlights application of silt density probe. Density depth profile of dredged material in hopper accurately determined using Harwell silt density probe, which measures 'in situ' density by detecting back scatter of gamma radiation emitted from probe. General results of experiments given.

0418 __________. 1980. "Erosion of Cohesive Sediments in Estuaries: An Engineering Guide," Hydraulics Research Station, Wallingford, U. K.

Prediction of siltation in navigation channels dredged in cohesive sediments, and mobility of cohesive dredged spoil at disposal ground requires knowledge of erosion properties of sediments. Paper presents and compares results of bed consolidation and erosion tests on three muds and concludes it is possible to deduce quantitative relationships for erodibility of cohesive sediments applied in preliminary design studies of engineering schemes involving similar cohesive sediments. Laboratory investigation and analysis may determine specific erosion characteristics of particular sediment for purpose of detailed prediction and design calculations.

0419 TIEDERMAN, W. G. and REISCHMAN, M. M. 1973 (Jul). "Feasibility Study of Hydrocyclone Systems for Dredge Operations," Contract Report D-73-1, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Purpose of study was determine feasibility of hydrocyclone separators for concentration and clarification of dredge spoil. Feasibility of using hydrocyclones for sand and gravel recovery while rejecting fine silt also investigated. Hydrocyclone proved successful at recovering sand from full range of spoils. System recommended for this application of classifying solids in dredge spoil.

0420 TRAWLE, M. J. and BOYD, J. A., JR. 1978. "Effect of Depth on Dredging Frequency; Survey of District Offices," Technical Report H-78-5, Report 1, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Objective of investigation was evaluate effectiveness of advanced maintenance dredging (overdepth dredging) in reducing dredging frequency and/or costs in maintenance of coastal and inland channels and harbors and establish necessary guidelines for governing practice.

0421 TROMP, J. T. and HOLTROP, R. L. 1980 (Oct). "The Design of a Self-Propelled Cutter Suction Dredger," Proceedings, World Dredging Conference, WODCON IX, pp 135-148.

Cutter suction dredgers have limitations, such as limited working capability in sea waves, time taking delivery voyages and starting up procedures, difficult shifting operations in waterways with shipping traffic and limited length of delivery line to reclamation area.

Latest designs of self-propelled cutter suction dredgers overcome greater part of above mentioned disadvantages. Advantages, disadvantages and design aspects of self-propelled cutter dredger described and discussed. Also, most characteristic components and new developments described.

0422 TRUEMPER, T. 1974. "Investigations into the Optimum Use of Suction-Cutter Dredges," Baumaschine und Bautechnik, Vol 21, No. 5, pp 159-162.

Model test purpose to determine influence of various factors on capacity of cutter head attainable in dislodged soil per time unit. Results show shape of cutter head as well as revolutions per minute and vibratory speed are of particular influence. In German with English abstract.

0423 TURCHANINOV, S. P. 1976. "Investigation in the Laws of Hydro Abrasive Wear of Inclined Pulp Ducts," Mechanical Sciences Mashinovedeniye, Vol 2, pp 57-60.

Paper considers process of hydro-abrasive wear of pipe walls as function of slope angle of pipeline in hydraulic conveyance of pulped rock in descending and ascending pipe flows. Analytical relationships of hydro-abrasive wear intensity in sloping pulp ducts obtained.

0424 TURNER, T. M. 1972 (Oct). "Submerged Pump Meets Challenge in Deep Dredging," World Dredging and Marine Construction, Vol 8, No. 11, pp 28-32.

Two types of pumps used for dredging are hull mounted centrifugal pump and suction jet booster. Neither system is capable of digging deep channels efficiently, so submarine slurry pump developed to fulfill need. Complete description of pump presented.

0425 __________. 1973. "The Compensated Cutter Head Dredge - Key to Offshore Mining," Proceedings, World Dredging Conference, WODCON V, pp 531-544.

Compensated cutter head dredge, when designed to cope with hostile offshore environment, shows great promise in meeting vast future demand for sand and gravel.

0426 __________. 1975. "Electric Submerged Pumps - an Overdue Development," Proceedings, World Dredging Conference, WODCON VI, pp 341-352.

Author gives reasons for believing that most major dredges built within coming decade will be equipped with submerged dredge pumps, and many existing dredges will be rebuilt to receive them. Description of 1,000-hp ELLICOTT submerged pump completes article.

0427 TURNER, T. M. 1975. "Open Pit Mining and the Dredge," Transactions, Society of Mining Engineers, AIME, Vol 258, No. 4, pp 299-300.

Author considers use of dredges in open pit mining, and suggests that they may help solve problems caused by environmental restrictions and non-availability of equipment. Types of dredge are listed, and working of cutter suction dredge described.

0428 ________. 1976. "Modern Trends in Dredge Design," Proceedings, Specialty Conference on Dredging and Its Envoronmental Effects, ASCE, pp 173-179.

Paper discusses major components of modern cutterhead dredge with thought of increasing efficiency of each function and hopefully making a contribution to economic objectives of dredging industry, while minimizing environmental effects.

0429 ________. 1976. "The Bucket Wheel Hydraulic Dredge. The Modern Mining Tool," Proceedings, Placer Exploration and Mining Short Course, University of Nevada.

Author presents bucket wheel hydraulic dredge as effective mining tool. He compares dredge to traditional bucket dredgers and cutter suction dredgers.

0430 ________. 1977 (Feb). "The Bucket Wheel Hydraulic Dredge," World Dredging and Marine Construction, Vol 13, No. 3, pp 23-27.

Author compares operation of bucket line dredgers with conventional cutter suction dredgers, explaining that cutter suction head as used in other operations may leave heaviest dredged material in water. Bucket wheel developed to overcome problems of conventional cutter, and has ability to work in horizontal strata, which are common in alluvial deposits. Seven basic dredging laws summarized and applied to hydraulic bucket wheel. Costs considered, and bucket wheel dredger recommended for mining operations.

U

0431 USUBA, S. 1977 (Apr). "1,000 Cu M Trailing Suction Hopper Dredger, 'Kamchatskiy' for Sudiomport, U.S.S.R.," IHI Engineering Review, Vol 10, No. 2, pp 71-77.

1,000 cu m trailing suction hopper dredger "KAMCHATSKIY" designed. Ship equipped with long discharge boom for agitation dredging work and is capable of three kinds of dredged matter discharging methods: agitation dredging, shore dredging, and hopper dumping methods. Ship is provided with modern instruments for dredging work, and special considerations given to design of ship to cope with dredging work in cold districts.

V

0432 VAN DEN BOOGERT, J. 1973 (Feb). "Concepts in Loading Hopper Dredges Defined," World Dredging and Marine Construction, Vol 9, No. 3, pp 13-17.

Article describes concepts and definitions which exist in relation to loading of hoppers and shows why time required to load trailing-suction hopper dredge varies in practice. Factors such as specific gravity of sand, overflow losses, influence of soil type on loading time and how this can be predicted are discussed.

0433 VAN DEN KROONENBERG, H. H. 1978. "A New Approach to the Design of Offshore Mining Equipment," Marine Mining, Vol 1, No. 4, pp 327-347.

New mining methods and mining equipment designed for offshore environment. For designing new equipment, design method proposed in which design process is divided in 3 phases. In 1st phase of design process, functions of mining system established. In 2nd phase, working principles, based on physical phenomena, generated for each function and best combination selected. In 3rd phase, final design completed with selection of material and method of fabrication.

0434 VAN DER SCHRIECK, P. G. J. and DUPONT, P. 1973 (Nov). "The Freeboard and Stability of Dredgers and Barges with Bottom Opening Doors," Shipping World and Shipbuilder, Vol 166, No. 3887, pp 1220-1221.

After 1966 International Load Line Convention (ILLC 1966) was enforced; previously 'non-convention' vessels such as dredgers and similar craft became 'convention' vessels, and issuance of Load Line Certificates became required, one for international voyages and the other for working condition. Article gives various international and working freeboards assigned to dredgers. Examples cited which show how freeboards were arrived at to meet stability requirements.

0435 VAN DER VET, A. C. W. 1978. "Dredging--War Against Wear," Nautical Review, Vol 2, No. 4, pp 14-15.

Author describes phase 1 of Commercial Harbour construction at Jubail on Arabian Gulf. Work called for by contract to dredge and reclaim land and in addition construct 12 km of dam.

0436 VAN DER WEIJDE, R. W. 1978 (Sep). "Port of Rotterdam: Industrial Center Copes with Continuous Silting," World Dredging and Marine Construction, Vol 14, No. 9, pp 38-43.

Location of Rotterdam at lower reaches of Rhine and Meuse rivers makes city an excellent junction for commerce, industry, and traffic. To allow larger ships to enter, Europoort created for harbor basin in far west part of port, providing direct connection with North Sea.

Maintenance dredging in harbor basins carried out by trailing suction hopper dredge, bucket dredges, floating grab dredges, and floating pumping stations for discharging mudbarges and pumping dredged materials to disposal sites.

0437 VAN DIXHOORN, J. 1973. "Modern Dredging Techniques," Terra et Aqua, No. 3/4, pp 28-35.

Modern dredging techniques characterized by:
a. operating possibilities offshore and in open sea;
b. combination of deepening and reclamation works, via dredging chain;
c. high production capacities in chain, obtained by functional differentiation and increase of units and equivalent seaworthiness.

Exclusive offshore or open-sea civil engineering projects, of large and multi-purpose character, not only feed development of fundamentally new dredging tools, but also increase their economic feasibility.

0438 VAN DOOREMALEN, J. J. C. M. 1973. "New Developments in Integrated Processing Systems on Sand and Gravel Dredgers," Proceedings, World Dredging Conference, WODCON V, pp 369-390.

All components playing part when loading, classifying and discharging sand and gravel from hopper suction dredge discussed.

Model tests and full size trails of "Venturi" draghead discussed.

Subjects as shape of hopper, emptying system, emptying periods, attainable mixture concentration, discharging times, cyclones and sand/gravel centrifuges reviewed.

General arrangement of gravel hopper suction dredger, designed according to latest research, presented.

0439 VAN DOOREMALEN, J. J. C. M. and VAN WAALWIJK VAN DOORN, S. C. 1975. "Static Screens for Sea Going Gravel Dredgers," Proceedings, First International Symposium on Dredging Technology, BHRA, pp H2-21 - H2-48.

Sand/gravel mixture obtained by seagoing stationary or trailing-suction hopper dredgers contains considerable amount of sand and is necessary to screen mixture before loading hopper with gravel. Simple static screen developed. Effects of screen width, screen slope, screen length and different types of screen deck discussed. Application of screen aboard trailing suction hopper dredgers discussed and recommendations for optimum parameters of screen made.

0440 VAN DOOREMALEN, J. J. C. M., LOHMAN, T. A. M., and CORNELIS, C. A. 1980. "Automation on Trailing Hopper Dredgers," Proceedings, World Dredging Conference, WODCON IX, pp 873-888.

Dragarm automation description shows how conventional hardware solutions are substituted by software solutions. Microprocessor systems designed for operating trailing hopper dredger described.

Different processor systems designed for automatic operation of several functions in dredging cycle such as: pipe handling, valve setup,

pump control, light mixture overboard, draft/trim control and dump control. Communication between different systems based on master/slave concept.

Master processor controls several "sub-systems" and is programmed for several dredging modes. Sub-systems designed in way that in case of emergency they can operate independently, or, if necessary, can be overruled by manual control. Design approach to develop system described.

0441 VAN DRIMMELEN, N. J. and GOOSSENS, L. 1979. "Semi-Submersible Dredge," Proceedings, Eleventh Annual Offshore Technology Conference, Vol 2, pp 851-862.

New dredge developed which provides solution to problems of stationary dredging operations in open sea and has semi-submersible hull. Paper deals with design for Semi-Submersible Dredge (SSD) destined for operations in southern areas of North Sea. SSD offers opportunity to supply sand to coastal areas from open sea under circumstances in which conventional dredging equipment is unable to operate.

0442 VANONI, V. A. (Editor). 1975. Sedimentation Engineering, Manuals and Reports on Engineering Practice No. 54, ASCE, New York.

Contents: Nature of sedimentation problems; sediment transportation mechanics; sediment sources and sediment yields; sediment control methods; economic aspects of sedimentation; American sedimentation law and physical processes.

0443 VANONI, V. A. ET AL. 1970 (Jul). "Sediment Transportation Mechanics: J. Transportation of Sediment in Pipes," Journal, Hydraulics Division, ASCE, Vol 96, No. HY7, pp 1503-1538.

Objectives of paper are: (1) present survey of existing knowledge on transportation of sediment in pipes; (2) examine similarities and differences of previous findings; and (3) suggest design criteria based on present status of knowledge. Presentation limited to transportation of cohesionless sediment as Newtonian solid-liquid mixtures.

0444 VAN OOSTRUM, W. H. A. 1979. "Operations Research in Dredging," Terra et Aqua, No. 18.

Attention given to improving mechanical and technical components of dredging system. Attempts made to raise output by improvement of dredging operation management. Computerized data-handling systems form unavoidable basis for further integration of basic activities of dredging work.

Large capital and maintenance dredging works form ideal test to develop efficient dredging methods. Operations research techniques playing increasingly important role and several projects have led to practical results such as programmed dredging, flight recorders, survey and positioning automation, routing programs and navigation programming.

0445 VAN OOSTRUM, W. H. A., PARKER, W. R., and KIRBY, R. 1980. "Maintenance Dredging in Fluid Mud Areas," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 177-190.

Examples discussed are location of port facilities in zones of low sedimentation or prevention of silt penetration using locks, bubble curtains or removable barriers. Where siltation cannot be avoided it may be handled more efficiently by either concentration into traps or spreading. In many areas of very high sedimentation, only way to cope with large sediment flux is by agitation dredging.

In fluid mud areas dredged by conventional trailer suction dredgers, increases in efficiency and production must be sought in improvements in surveying methods and dredge plant design. In this connection, density measurements are replacing conventional echo sounding surveys.

0446 VAN OVEREEM, A. J. A. 1968. "Sonia Continuous Profile," Proceedings, World Dredging Conference, WODCON II, pp 78-91.

Shallow penetration continuous profiling carried out to supply information for offshore exploration and mining projects and for marine civil engineering studies.

Most straightforward way of improving discrimination is to shorten sound pulse. Shortening pulse is possible by increasing sound frequency but attenuation also increases rapidly with sound frequency. It follows that balance between discrimination and penetration largely determined by efficiency and design of apparatus used.

0447 VENNE, L. J. 1973 (May). "Quality Control for Cutters," World Dredging and Marine Construction, Vol 9, No. 6, pp 21-25.

Problems associated with selection of proper materials for wear resistance used in manufacture of dredge cutter steel parts discussed. Specialized instruments used in modern steel foundry to control properties of steel illustrated.

0448 VERMEULEN, T. 1980. "Automatic Cutter Dredger Control," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 58-78.

Systems for automation of cutter dredgers discussed in paper. Paper covers four generations of control systems.

Systems manipulate speed of cutter dredger swing, as well as forces in sidewires, to control primary parameters such as sidewire winch load, cutter load, dredge pump vacuum and pipeline velocity. Basic setup of different generations illustrated and main properties listed and compared. Problems and shortcomings that led to new developments discussed.

0449 VOCADLO, J. J. 1976. "Role of Some Parameters and Effective Variables in Turbulent Slurry Flow," Proceedings, Hydrotransport 4, BHRA, pp D4-49 - D4-61.

Paper draws attention to important parameters and variables which must be considered and understood to predict flow behaviour of industrial slurries. It is shown how parameters, such as relative viscosity, maximum concentration, limiting viscosity at high rate of shear, yield stress and effective values of some independent variables can explain a variety of flow phenomena. Relevant variables discussed with reference to typical data mainly based on author's previous work and relationships proposed to describe flow properties of complex slurries.

0450 VROEGE, C. J. and DE LEEEW, R. 1978. "Developments in the Design of Dredging Equipment," Proceedings, World Dredging Conference, WODCON VIII, pp 115-130.

Method developments of dredging and dredging equipment have been governed by following factors: development of larger oil tankers and bulk carriers which required larger and deeper harbors and harbor approaches; need for harbors in areas where sea consisted of rocky material; and construction of large dams such as Thames Barrier, Delta works in Netherlands, and hydrodynamic installations such as tidal power station at Rance. This has resulted in continuous interaction between designers of harbors and developers of dredging equipment.

W

0451 WAKABAYASHI, J. 1974 (Jul). "Dozers Give Robot Performance at Underwater Job Sites," Construction Methods and Equipment, Vol 56, No. 7, pp 90-91.

Japanese contractor has successfully used remote-controlled bulldozers for underwater ripping and excavating of hard rock too difficult for conventional dredges. One dozer spread sand on ocean bed for bridge pier mats.

0452 WAKELING, H. L. 1975 (Nov). "Future Dredging Need," Civil Engineering (London), pp 28-29.

Article discusses future development in improving efficiency and adaptability of bucket, cutter suction and trailer hopper suction dredgers. Other projects, including Suez Canal, artificial islands, and mining sea bed materials, are mentioned. Author considers that semi-submersible platform structures on which dredging equipment can be mounted might prove a suitable compromise.

0453 WAKEMAN, T. H., DICKSON, W. J., and SUSTAR, J. F. 1974. "Alternative Dredging Methods Relative Physical Impact," Proceedings, World Dredging Conference, WODCON VI, pp 429-453.

San Francisco District study is directed towards evaluating physical impacts of equipment used in San Francisco Bay for dredging: (i) trailing suction hopper dredges, (ii) grapple dredges and (iii) cutterhead pipeline dredges. Impact is defined by conditions induced by operation as they relate to sediment chemistry, ecology, channel hydraulics, and other uses or demands placed on water resources. Studies were performed to differentiate degree of disruption caused by various types of equipment and their associated levels of suspended solids. Paper describes studies undertaken to define physical impacts of various alternative dredging methods and results of those studies.

0454 WALDECK, F. 1974 (Sep). "Portable Dredge's Changes Told," World Dredging and Marine Construction, Vol 10, No. 10, p 12.

Dredge described was built in Portland, Oregon. 12-foot by 30-foot hull was built of wood. It had hand-operated wooden spuds and a reinforced pipe ladder. It had no cutter, only a simple agitator powered by a jack shaft driven by the main pump engine. Capacity was 20 cubic yards per hour through 800 feet of pipeline with maximum lift of 10 feet.

0455 WATANABE, R. 1968. "Methods of Dredging and Long Distance Material Carrying in Japanese Civil Engineering Project," Proceedings, World Dredging Conference, WODCON II, pp 567-595.

In Seto Inland Sea and elsewhere, large-scale dredging projects have been undertaken. In coastal reclamation programs, it is increasingly difficult to find shallow beaches where good sand is readily available. Sources of sand supply are more distant from reclamation sites, making it highly important to develop economical ways of transporting tremendous quantities of sand over long distances. One such method already in use is a "barge line system" involving barge-loading hydraulic dredge, push boats, and barges. Method of material transportation adopted depends largely on carrying distance involved. Pushed barges are generally preferable for distances up to 50 km, whereas large sand carriers are more economical for longer distances. Author describes the two methods of transportation with emphasis on relative profitability for medium and long distances.

0456 WEBB, D. H. and HOLMES, A. P., JR. 1976. "Legislative Impact of P. L. 92-500 on Dredging," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 83-114.

Paper traces purpose of Federal Water Pollution Control Act and discusses law with regard to Section 404 (Corps of Engineers permit program) and Section 402 (National Pollution Discharge Elimination System program). Significant cases interpreting law are discussed.

0457 WEBB, R. J. 1971 (Nov). "Numerical Dredging," Dock and Harbour Authority, Vol 52, No. 613, pp 319-320.

Progress report on research project sponsored by British Transport Docks Board into dredging techniques. Project involves use of a mathematical model which tests cost and practicality of existing and future schemes.

0458 WEBB, R. J. and COLEMAN, M. J. 1975. "Operations Research in Dredging," Terra et Aqua, No. 8/9, pp 12-18.

Article discusses applicability of operations research (OR) methods to dredging operations. Example is given of study of fatigue in dredger crews. OR can also be applied to cost studies and bidding strategy. OR methods depend on access to adequate systems of data collection and storage for model formulation.

0459 WEBER, M. 1976. "The Air-Lift Method and Its Applicability to Deep Sea Mining," Proceedings, Interocean '76, DM, pp 127-145.

Two newly developed computation methods for air lifts are presented, the validity of which has been ascertained by large scale experiments with pipe diameters of 300 mm and depths of 450 m. Very great air flow rates and velocities towards end of pipe are to be expected in deep sea mining owing to great expansion of air. As a consequence, water lifting power is diminished and great losses are caused, setting a technical and economic limit to use of air lift method. Extreme operating conditions of this type are under investigation at the University of Karlsruhe to obtain precise data on limits of economically justified air lift method.

0460 WEBER, M. and DEDEGIL, Y. 1976. "Transport of Solids According to the Air-Lift Principle," Proceedings, Hydrotransport 4, BHRA, pp H1-1 - H1-23.

New calculation method based on empirical values and theory makes it possible to calculate vertical hydraulic solids transportation in pipes according to the air-lift principle and lay out suitable conveying systems. Procedure is based on superposition of air/water flow on water/solid flow to form three-phase air/water/solids flow. Data obtained correspond to experimental results within wide range (for diameters 20-300 mm, lengths 0-500 m). Method is of interest not only for conveying solids but in general for calculation of three-phase fluidized beds.

0461 WEBER, M., DEDEGIL, Y., and FELDLE, G. 1978. "New Experimental Results Regarding Extreme Operating Conditions in the Lifting and Vertical Hydraulic Transport of Solids According to the Jet Lift Principle and Its Applicability to Deep-Sea Mining," Proceedings, Hydrotransport 5, BHRA, pp F7-109 - F7-132.

Computations for air lifting in deep-sea mining have shown the resulting three-phase mixtures will surpass present empirical knowledge regarding excessive air content due to expansion. For this reason experiments have been made to cover great air components. Simultaneously, knowledge has been obtained in how far the assumed velocity composition and superposition of air-water and water-solids mixture to form three-phase mixture actually apply. With these results, more reliable statements can be made regarding applicability of air lift to deep-sea mining from several thousand metres.

One method under discussion for lifting solids from several thousand metres is the jet pump system. Theoretical data are given based on momentum balance and pressure balance of total system. Data make it possible to optimize plant design and determine pump capacity as well as overall efficiency. Theoretical computations are confirmed by experimental results. The beginning of transport and its limitation by cavitation are investigated.

0462 WEISMAN, R. N., COLLINS, A. G., and PARKS, J. M. 1980. "Stabilization of Tidal Inlet Channels by Fluidization," Proceedings, World Dredging Conference, WODCON IX, pp 573-588.

Research reported concerns concept of stabilizing a channel by fluidizing bottom sediments. Laboratory flume studies have shown that continuous fluidization along a buried fluidizing pipe can be achieved. Pipe has small holes at regular intervals through which water is pumped, fluidizing overlying sand. Data taken with laboratory setups have provided basis for prototype design. Hole size, spacing, and system flow rate to achieve fluidization can be chosen. Also tested were methods of removing fluidized sand: gravity flow along sloped pipe, slurry pumping, and scour by ebb current. Field test is planned to test concept in natural environment.

0463 WELLS, J. E. 1974 (Aug). "Production Meter Helps Increase Dredge Production," World Dredging and Marine Construction, Vol 10, No. 9, pp 14-16.

Author reports how Ellicott production meter is helping dredges increase production. Meter presents displays of specific gravity, pipeline velocity, and production rate, as well as accumulated solids pumped.

0464 WELTE, A. 1967. "Hydraulic Bucket Chain Drive," Proceedings, World Dredging Conference, WODCON I, pp 173-195.

Hydro-dynamic FOTTINGER Torque Converter approaches characteristic of steam engines because of automatic adaptability to load on output side of power transmitting system. Torque converter has been introduced in recent years by dredge manufacturers for power transmission between diesel engine and bucket chain.

0465 __________. 1970 (Oct). "Action of Centrifugal Dredging Pump," World Dredging and Marine Construction, Vol 6, No. 12, pp 27, 32, 36.

Observation of centrifugal dredge pump with connected delivery pipe and diesel engine adjustable to many speeds revealed insufficient knowledge of interactions that frequently resulted in faulty decisions and expensive delays. Clarification by showing characteristic curves of interaction units and offering insights into their correlations is presented.

0466 __________. 1972 (Jun). "Increasing the Efficiency of Suction Dredging," International Construction, Vol 11, No. 6, pp 17-22.

Extent in which efficiency and economy of suction dredging equipment depends on arrangement of centrifugal pump is explained. In most cases it is not delivery conditions in the pipeline that are decisive but conditions encountered when breaking up solids and taking solids up by suction unit.

0467 __________. 1972 (Nov). "Tensioning Determines Bucket's Efficiency," World Dredging and Marine Construction, Vol 8, No. 12, pp 22-25.

Diagrammatic representation of VOITH Torque Converter, Type RL 18, with high-speed step and bevel wheel reversing reduction gear and spur wheel flange gear used for power transmission diesel engine and bucket chain. Tension frames carry main bucket ladder bearings which are supported at sides on longitudinal bars and held in frame by stoppers.

0468 __________. 1975. "New Processes of Unloading Trailing Suction Hopper Dredgers," Proceedings, First International Symposium on Dredging Technology, BHRA, pp H1-1 - H1-20.

Self-propelled hopper suction dredgers either dump spoil through bottom doors or discharge it through connected pipelines by means of on-board centrifugal pumps. Latter operation increasingly gains importance, as the spoil can often be used in land reclamation for industry and residential areas. Economics of solids discharge from hopper suction dredgers, however, leave much to be desired. Improved method of discharging solids is introduced, supported by comparative model and full-scale tests demonstrating superiority compared with conventional discharge method.

0469 WELTE, A. 1975 (Jul-Aug). "Novel Methods of Solids Discharge from Hopper Suction Dredges," Baumaschine und Bautechnik, Vol 22, No. 7-8, pp 225-230.

Details of solids discharge by flushing are described. Model tests showed that, by adding flushing water, discharging hopper can be improved substantially. This was verified by large-scale test carried out with hopper suction dredge.

0470 __________. 1977 (Dec). "Loading and Discharging Trailing Suction Dredgers," International Dredging and Port Construction, Vol 5, No. 2, pp 29, 31, 33, and 35.

Summary of technical developments for loading and discharging trailing suction hopper dredgers. When loading, it is important that solids settle completely and quickly to minimize overflow losses. Central loading boxes, smooth hoppers and adjustable overflow systems with anti-turbidity characteristics have led to considerable improvements.

0471 WENTZELL, H. F. 1977. "Electronic 3-D-Positioning of the Dredge Head Improves Economy of Bucket and Cutter Dredge Operations," Proceedings, Second International Symposium on Dredging Technology, BHRA, Vol 1, pp D2-21 - D2-32.

System described consists of Mini-Ranger III range measuring equipment to determine position of reference point at dredge. With additional information from a compass and inclinometer, position and depth of dredge head are displayed using data processor. Light indicator for depth and X-Y plotter for geographical position of dredge head aids in positioning head within given tolerance frame and allows slanting slope dredging method. System aids dredge master in returning to any point within and beyond present dredging area.

0472 __________. 1978 (Mar). "Dredge Head Positioning System Improves Economy in Operations," World Dredging and Marine Construction, Vol 14, No. 3, pp 10, 12, 14, 16 and 17.

System described consists of Motorola Mini-Ranger III range measuring equipment used to determine position of reference point at dredger. Using additional information from a compass and inclinometer, position and depth of dredge head are displayed by data processor. Depth information is output to light indicator and geographical position

to X-Y plotter aiding in positioning dredge head within given tolerance frame and allowing slanting slope dredging method. System aids dredge master in returning to any point within and beyond present dredging area.

0473 WESTLUND, J. and KELLEY, C. 1973 (Nov). "New Floating Clamshell Dredge Uses Hydraulic Hoist Equipment," World Dredging and Marine Construction, Vol 9, No. 13, pp 38-40.

Prototype for new series of floating clamshell dredges is equipped with 5-cubic yard bucket and utilizes simple and reliable hydraulic hoisting equipment instead of electric hoists. Double drum electric hoists previously used on clamshells are replaced by single hydraulically powered drum which operates hoisting and lowering of bucket.

0474 WESTNEAT, A. S. 1976. "Remote Classification of Marine Sediments," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 289-298.

Acoustic echoes from sub-bottom profiler are examined by computer processing for significant relationships that describe sediment physical properties. Technology offers new tool for bottom studies. Acoustic wave generated in water column can penetrate seafloor and be reflected sequentially from interfaces between layers of differing physical properties. Echo is modified by passage through soil in ways that relate to fundamental characteristics of sediment. Processing these echoes by computer gives estimates of important sediment properties.

0475 WICHERS, J. E. W. 1980 (Oct). "On the Forces on a Cutter Suction Dredger in Waves," Proceedings, World Dredging Conference, WODCON IX, pp 899-922.

Paper deals with behavior of cutter suction dredger in waves. Conventional cutter suction dredger can meet problems when it operates in waves. Two important phases can be distinguished: i.e.

- moored condition
  Dredger is restrained by spud and cutter ladder swing wires, while ladder is raised.
- operational condition
  Ladder is lowered and cutter head is working.
  Dredger is restrained by spud, ladder swing wires and cutter head itself.

Model tests in regular waves were carried out with cutter suction dredger in both conditions. For the moored condition with dredger in head waves, an existing method for computating hydrodynamic coefficients, wave loads and motions of floating bodies of arbitrary shape was applied. Calculated motions of dredger and calculated spud forces agree well with values measured on model. Results of model tests simulating operational condition are presented. Results give insight into causes of high loads on cutter head and spud and characteristics of loads. Future efforts with respect to predicting loads on cutter head and spud in operational condition are discussed.

0476 WIEDENROTH, W. 1971 (Oct). "Transportation Problems of Sand-Water Mixtures in Pipelines and Centrifugal Pumps," World Dredging and Marine Construction, Vol 7, No. 11, pp 21-29.

Author describes tests made to determine behavioral characteristics of materials commonly transported in dredging while in pipelines and in centrifugal pumps. Tests were carried out using sands and gravels of varying shapes and sizes to determine terminal falling velocities and particle wearing. Behavior of these materials in pipelines under different conditions of density, mixture, and flow velocities are discussed. Author tests behavior of five sands and gravels of different volumetric concentrations in two different centrifugal pumps under differing rotation speeds. Transportation and paint wear test results show that friction paths followed by pump mixture should be kept as short as possible, and deflections made as gradual as possible to achieve good transport behavior and low wear.

0477 WILLINGHAM, G. 1978 (Jan). "A Study of the Optimisation of Echo Sounders," International Dredging and Port Construction, Vol 5, No. 3, pp 13, 15 and 17.

Author identifies three major limitations of acoustic measuring systems and discusses each: (i) timing errors; (ii) spatial errors; (iii) propagation errors. Author discusses how design of echo sounding equipment might be optimised.

0478 WILLINGHAM, G. C. 1975 (Jul). "Electronic Distance Measuring - a Valuable Tool in Dredging," World Dredging and Marine Construction, Vol 11, No. 8, pp 24-26.

Article describes how electronic distance measuring system can provide accurate information for operating dredge. Functions of electronic distance measuring equipment are discussed, with particular reference to a unit in England. Accuracy of system is discussed.

0479 WILLS, R. 1978 (Sep). "San Francisco Bay: Maintaining a Waterway to the World," World Dredging and Marine Construction, Vol 14, No. 9, pp 63-69.

San Francisco Bay is world's largest landlocked harbor. Most dredging in major navigation channels is accomplished by government owned hopper dredges or clamshell dredges under contract. Twelve river and harbor dredging projects have been authorized. Some 8 other projects are maintained by the Army Corps of Engineers (ACE) at request of USCG, USN, and U.S. Army. Key dredging project is main ship channel (also known as bar channel) at bay's entrance. Other ports serviced by ACE dredging are Oakland Harbor, Inner Harbor, and Port of Richmond. Dredging activities at these ports are briefly discussed. San Francisco Bay and Delta Hydraulic Model operated by ACE is discussed.

0480 WILSON, J. F., AWASALLA, N. G., and BIGGERS, S. B. 1972. "Stability of Ocean Mining Pipelines Containing Transient Mass Flow," Preprints, Fourth Annual Offshore Technology Conference, Vol 1, pp 711-722.

Nearly vertical vacuum pipelines, designed to elevate ore nodules from ocean floor to dredge ship, can become dynamically unstable and fail for certain ranges of following parameters: damping; line tension; ratio of flow rate parameter to fundamental pipeline frequency; ratio of pipe mass to flowing mass; ship motion as it affects pipe tension and end displacement; pipeline inclination angle; and steady vortex shedding around line due to ship speed and currents. Numerical results show effects of each system parameter on uniform pipeline hinged at each end and pretensioned with dead weight. Although dynamic deflections are unbounded in some cases, they do not exceed two times the maximum static deflection for many practical designs. Results illustrate danger of relying on static design methods for deep water mining, especially for lines exceeding 2500 ft.

0481 WILSON, K. C. 1975. "Stationary Deposits and Sliding Beds in Pipes Transporting Solids," Proceedings, First International Symposium on Dredging Technology, BHRA, pp C3-29 - C3-40.

Analysis shows limit of stationary-deposit zone occurs when driving force overcomes mechanical friction of grains against pipe wall. Results are displayed on dimensionless coordinate system which, for any specific case, can be reduced to usual j-V axes by simple transforms. With increasing concentration, velocity for deposition limit passes through maximum and then decreases. This behavior, which has been verified experimentally, supports conclusion that Durand's F_L correlation fails to take all factors into account. Force balance equations can be extended to case of stratified flow, i.e. flow with sliding bed, and calculated pressure drop curves are more realistic than those predicted by Newitt's correlation. Example of use of calculated values for specific application indicated optimum transport efficiency occurs at very high concentration and relatively low velocity. Prediction suggests promising field for future development.

0482 __________. 1976. "A Unified Physically-Based Analysis of Solid-Liquid Pipeline Flow," Proceedings, Hydrotransport 4, BHRA, pp A1-1 - A1-16.

Equations dealing with flow of solid-liquid mixtures generally have been obtained from data-correlation techniques. Physically based analysis is required. Analysis divides moving solids into two components - suspended load and contact load. Proportion of solids travelling as suspended load can be determined by equation. Contribution of suspended load to pressure gradient is found from specific gravity of mixture. Contact load is moving layer near pipe invert, and force-balancing analysis originally developed in connection with limit of stationary deposition has been extended to this moving layer. Output from analytic model is plotted on generalized coordinates. For any specific case,

simple transforms can be applied to obtain excess pressure gradient in terms of contact-load concentration and throughput velocity. Predictions of analytic model for contact load are in close agreement with experimental results of Fowkes and Wancheck. Application of analysis to practical problem is illustrated by example showing how gradient-velocity curves are obtained for non-uniform material involving suspended and contact load.

0483 WILSON, W. E. 1942. "Mechanics of Flow with Non-Colloidal Inert Solids," Transactions, ASCE, Vol 107, pp 1576-1596.

Study provides elementary theory on which available experimental data on solids transportation in pipes may be interpreted. Theory is neither complete nor directly concerned with mechanics of turbulence process in maintaining solids in suspension, but rather represents analysis of flow mechanics on basis of energy relationships. It results in explanation of several important but unsatisfactorily explained flow features. Experimental data from several sources are presented and analyzed on basis of theory.

0484 WING, R. H. 1971. "Slurry Flow in Small Diameter Vertical Pipes," Proceedings, World Dredging Conference, WODCON IV, pp 645-685.

Theory of vertical flow is reviewed and investigations compared. Tests conducted at Marine Minerals Technology Center (MMTC) are reviewed, test apparatus described, and data presented. Friction head loss for large particles at high velocities is equal to water at same velocity. How large particles must be and how great the velocity are in doubt. Guidelines are given in this respect.

0485 WITTS, L. G. 1975. "Welded Protective Coatings to Combat Wear," Proceedings, First International Symposium on Dredging Technology, BHRA, pp G1-1 - G1-18.

Paper considers types of wear, abrasion, impact, friction, etc., and shows applications where they take effect. Paper discusses merits and economic advantages of welded protective coatings. General outline of processes and alloys used for wear facing is included. Paper concludes with case histories where welded protective coatings have increased wear life, typical applications being dredging buckets and pumps. Case histories include cost analysis details showing considerable cost savings achieved.

0486 WOLFE, S. E. 1967 (Feb). "The Transport of Solids in Helically-Ribbed Pipes," Canadian Mining and Metallurgical Bulletin, Vol 60, No. 658, pp 221-223.

Helical ribs in smooth-bore round pipe transport granular solid particles at lower velocity than required to transport same in smooth pipe. Helical motion imparted to flowing mixture returns settled particles to main stream. Flow may be stopped and restarted without

difficulty. Due to lower velocity required, large power savings are realized and wear on pipe walls is much reduced. Ribs should have high angle relative to pipe long axis. Lineal spacing between adjacent ribs should be modest.

0487 WOOD, D. J. 1980. "Slurry Flow in Pipe Networks," Journal, Hydraulics Division, ASCE, Vol 106, No. HY1, pp 57-70.

Basic equations required to carry out steady-state analysis of slurry flow in pipe network are presented. Computer program has been developed and example calculations are presented.

0488 WOOD, D. J. and KAO, T. Y. 1966. "Unsteady Flow of Solid-Liquid Suspension," Journal, Engineering Mechanics Division, ASCE, Vol 92, No. EM6, pp 117-134.

Basic energy and momentum relationships are used to obtain analytical expressions for pressure and flow variations in suspended solid-liquid flow. Suspended flow occurs in pressurized conduit system, and transients are introduced by rapidly closing a valve. Pressure wave magnitudes and shapes generated by this action are investigated. Expressions are obtained describing momentum exchange resulting from viscous action between phases that occurs behind wave front. Experimental results are obtained for several solid-liquid suspensions. Good agreement between theoretical and experimental results is obtained.

0489 WOODBURY, C. E. 1971 (Nov). "Special Mechanical Requirements in Problem Areas of Hydraulic Dredge Design and Operation," World Dredging and Marine Construction, Vol 7, No. 12, pp 21-25.

Design of cutter-ladder arrangement, spudding, anchoring and swinging of dredge, performance of dredge pumps, and variable speed drives are discussed to assist owners and operators in realizing maximum capabilities of their dredge while avoiding shortcomings.

Y

0490 YAGI, T. 1970. "*Sedimentation Effects of Soil in Hopper*," Proceedings, World Dredging Conference, WODCON III, pp 1-22.

Hopper dredge production is dependent on soil excavating capacity of dragheads and dredge pumps, and sedimentation effects of soil in hopper. Many factors influence sedimentation in hopper such as particle size, opening area and capacity of hoppers, and nondisturbing devices. Paper derives loading efficiency under simplified conditions of above factors and compares theoretical formula with experimental data from model and field tests. Economical loading time for hopper dredge is proposed from results of field tests.

0491 YAGI, T. and OKAYAMA, Y. 1975. "Dredging Effects of Water-Jet and Teeth with the Drag Head," Proceedings, First International Symposium on Dredging Technology, BHRA, pp F4-39 - F4-50.

Dredging by trailing suction dredger for hard packed sand causes remarkable decrease of solids concentration and dredging efficiency. Field tests of trailing suction dredger equipped with water jet and teeth on drag head were conducted and effects of this auxiliary equipment investigated. Water jet is extremely effective for increase of solids concentration, especially for hard packed sand. Effects of teeth depend on shape and arrangement. It is desirable to weld teeth only on heel part because teeth welded to whole surface of grate brings about reverse effect. Peak of solids concentration exists around ship's speed of 3 to 4 knots.

0492 YASUI, A. and MURATA, T. 1973. "Development of Underwater Bulldozer Systems," Journal of Terramechanics, Vol 10, No. 4, pp 13-20.

Two types of underwater bulldozer systems have been developed. First system is used in shallow water and has already been put to practical use. Second system for deep sea bottom is undergoing performance and durability tests. Methods of underwater work suited to this system are being developed in parallel with operator training. Experience obtained with these systems will be utilized in future projects to develop underwater construction systems.

0493 YOKOTA, A., ISHIBASHI, O., and YAMADA, N. 1976 (Jun). "Laboratory Study of a New Suction Dredge with Feedback Loop for Concentration Control-4. Fundamental Study on Exploitation Apparatus of Unconsolidated Seafloor Sediments," Journal of the Mining and Metallurgical Institute (Japan), Vol 90, No. 1060, pp 415-420.

Device differs from regular suction dredges in special suction-head attached to forward end of suction pipe joined to sand pump, in venturi-type concentration detector in suction pipe, and in automatic control mechanism for concentration. Theory of operation, static

characteristics, and dynamic characteristics of dredging loose and thick sand bed are discussed. Tests of laboratory model show automatic control for concentration in pipe is successful.

0494 YOUNG, B. 1970 (May). "Dillingham Dredging 1000 ft. Wide Channel," World Dredging and Marine Construction, Vol 6, No. 6, pp 18-19.

Equipment and operations employed in dredging entrance of Vancouver, BC, Harbor are described. Channel is dredged through 10,000 ft stretch to deep water on each end. Material is moved by self-dumping split scows.

Z

0495 ZAHN, G. A. and SIAPNO, W. D. 1975. "Rationale for Navigation Systems for Manganese Nodule Mining," Proceedings, Ocean '75, IEEE and MTS, p 507.

Paper discusses requirements of navigation equipment for deep ocean mining. Presentation includes positional accuracy desired together with rationale for establishing requirements. Environment in which mining takes place is described and equipment and operational characteristics identified. Positions of surface vessel and bottom dredge must be established. Required accuracy is influenced by such factors as terrain variability, size and frequency of obstructions, survival capabilities and desired dredge path efficiency. Paper covers test and exploration phases with extension into commercial mining phase.

0496 ZAREA, S. and ROCO, M. 1975 (Sep). "Influence of Helical Flow on the Hydraulic Transport Capacity of Solids Through Pipes," Proceedings, First International Symposium on Dredging Technology, BHRA, pp C2-17 - C2-28.

Helical flow in dredge pipes shows advantages such as augmentation and uniformity of granular solids concentration in flow area, as well as reduction of mixture velocity and pipe wear. Analytical approach is made to effect of secondary flow on transport capacity increase. Experiments on two liquid/solid mixtures in spiral flow through pipes 100 mm in diameter provide data on specific hydraulic parameters. Practical solution for developing helical flow in dredge pipes is reported.

0497 ZIMMIE, T. F. and TOFFLEMIRE, T. J. 1978. "Maintenance Dredging and Toxic Substances," Proceedings, International Waterborne Transportation Conference, ASCE, pp 704-719.

Examples of dredging operations in Hudson River dealing with PCB contaminated sediments are discussed. Detention time, chemical treatment, floating booms, and landfill disposal sites are discussed.

0498 ZINKWEG, A. J. 1978. "Self-Propelled Cutter Suction Dredger," Ports and Dredging & Oil Report, Vol 96, pp 9-13.

Author examines problems of cutter suction dredging in swell conditions. He outlines advantage of designing dredger as fully seaworthy vessel so dredger can ride out storms and resume work when conditions improve, and also points out disadvantages with this system. Design of such a vessel is discussed. Author emphasizes choice between forward-mounted and stern-mounted cutter ladder which dominates all aspects of design. Advantages of latter arrangement over former are stated. Problems associated with stern-mounted ladder can be overcome by locating screws forward. This system is discussed.

ANONYMOUS

A

A0001 "Active Draghead Defeats Clay," World Dredging and Marine Construction, Vol 13, No. 6, May 1977, pp 17-18.

Active draghead designed to counteract blockage at head caused by clayey materials. Unit consists of outer casing inside of which are revolving cutters which cause heavy soils to disintegrate and form slurry. Scaled-down prototype tested and described.

A0002 "A Cutter Dredge," British Patent No. 1405581, Sep 1975.

Cutter dredge comprises ladder, suction tube supported by ladder and, having pivotable end portion, dished disk cutter mounted for rotation at end portion of suction tube with concave side of disk cutter facing free end. Vibrations no longer generated, and required power for cutting operation is substantially less.

A0003 "Adequacy of Dredging Methods and Equipment in the United States for Maintenance of Navigable Waters," Journal, Waterway, Port, Coastal, and Ocean Division, ASCE, Vol 103, No. 3, Aug 1977, pp 349-372.

Federal and private dredging fleet in U. S. reviewed to determine use rate and adequacy. Basic information and needs documented. Fleet generally obsolete and unable to fill current need for operations in exposed waters and for beach nourishment.

A0004 "A Dredging Head," British Patent No. 1464321, Feb 1977.

Dredging head designed for heavy material and fibrous material described. Also described is protective shield for augers intended to aid flow of water and material around augers and means for directing flow of material from augers to suction pipe.

A0005 "Advances in Marine Electronics Equipment," Fish Boat/Sea Food Merchandising, Vol 24, No. 2, Feb 1979, pp 59, 93-94.

Track plotter driven by Loran-C, scanning sonar, collision avoidance systems, and VHF scramblers all reviewed.

A0006 "Ailsa Delivers Large Gravel Dredger to U. K. Owner," Shipbuilding and Shipping Record, Vol 118, No. 21, Nov 1971, p 25.

Aggregate suction dredger, Sand Wagon, has length of 300 ft, beam of 53 ft 6 in., and draft of 20 ft 3-1/4 in. Vessel able to dredge from 90 ft depth.

A0007 "Al Wassl Bay," Holland Shipbuilding, Vol 28, No. 2, Apr 1979, pp 64-67.

Cutter dredger Al Wassl Bay described. Dredger's auxiliary fleet also described.

A0008 "A Mechanism for Driving a Work-Shaft," British Patent No. 1487208, Sep 1977.

Driving suction dredger cutterheads at slow speeds using deflectably mounted work-shafts described. Cutterhead drive and work-shaft, cutterhead driving motors and cutterhead transmission unit all move relative to ladder. Any distortion of ladder need not result in shaft misalignments and damage to transmission securing points.

A0009 "A Method and Arrangement for the Hydraulic Conveyance of Dredged Materials," British Patent No. 1400316, Jul 1975.

Floating pipelines used for conveying dredging material from moving suction dredger to stationary point which may be waterborne and anchored. Pipeline held under tension such that collapse prevented but there is no excessive loading on end attachment points.

A0010 "Amphibian Suction Dredge," Land and Water International, Vol 31, 1976, p 22.

30 cm cutter suction dredger described. Dredger capable of leaving water under own power as it is mounted on hydraulically driven caterpillar unit. Unit designed to have shallow draught and remove thin layers of silt from flat bottom. Maximum dredging depth 3.5 m.

A0011 "Apollo-Trailing Suction Hopper Dredger," Holland Shipbuilding, Vol 26, Aug 1977.

Twin-screw trailing suction hopper dredger Apollo described. Article, which includes general-arrangement drawings and partial list of equipment suppliers, describes dredging functions, dredging controls, hopper compartment, navigation equipment, engineroom, deck machinery, electrical installations, and accommodation.

A0012 "Apparatus for Conveying Loose Material," British Patent No. 1446798, Aug 1976.

Apparatus designed to convey loose material, especially sand and gravel, by conveyor line at free end of which is a conveyor head. Apparatus intended primarily for dredging operations. Advantage of system is that working depth is variable over substantially larger range than existing systems because effective depth position of conveyor head can be adjusted without swinging head out of its optimum working position as is required with existing systems.

A0013 "Apparatus for Loading a Hopper of a Suction Dredger with Sand," United States Patent No. 3878946, Apr 1975.

Invention relates to method of loading floating suction dredger with sand. Object of invention is to shorten loading times. Outline presented for suction dredger with system incorporated.

A0014 "Apparatus for Optimizing Dredge Production," U. S. Patent No. 3224121, Jan 1965, Secretary of the Army, Washington, D. C.

Patent describes metering and control devices designed to regulate production output of suction dredges.

A0015 "Apparatus for Securing a Dredger to the Sea Bed," British Patent No. 1430148, Mar 1976.

Device designed to cushion movement between dredger and spud keeper. Cushioning effect achieved by system of hydraulic rams operating on spud keeper body which continually return spud keeper to initial position relative to dredger.

A0016 "Apparatus for the Hydraulic Raising of Solids," British Patent No. 1505449, Mar 1978.

Apparatus described intended for deep sea dredging operations. Floating vessel equipped with motor unit which drives high pressure pump situated on-board vessel. Pump draws in working fluid which is forced at high pressure down pipe to drive turbine positioned approximately 1000 metres below surface, and is then either recirculated to pump or allowed to flow back into sea. Turbine coupled to centrifugal pump connected to suction head via delivery tube. Turbine and centrifugal pump assemblies described in detail.

A0017 "Aquarius, Latest Addition to the Fleet of Zanen Verstoep N.V. Built by Shipyard DeMerwede," Holland Shipbuilding, Vol 26, No. 3, May 1977, pp 44-47.

Cutter dredger "Aquarius" has length of 107.00 m, beam of 19.00 m, and draft of 4.50 m.

A0018 "A Suction Head for the Suction Pipe of a Suction Dredger," British Patent No. 1499015, Jan 1978.

Suction head fitted with cutter and crushing tools described. Crushers operated by hydraulic piston cylinders mounted on suction pipe. Crushers designed to cut material, free material from suction pipe inlet should it become blocked, crush such material and feed it to suction pipe. Aim of design is to avoid disadvantageous load torques that are normally associated with conventional rotary cutterheads.

A0019 "Automatic Vacuum Relief Valve Installation," Ports and Dredging & Oil Report, Vol 88, 1976, pp 24-25.

Article describes butterfly valve mounted on suction pipe of dredgepump to control dilution of dredged mixture by allowing plain water to enter pipe without first passing through suction inlet. Second, smaller valve on suction pipe, close to inlet, will further stabilize dredging process by preventing overloading of suction process.

B

A0020 "Boat with Wheels," Ship and Boat International, Vol 30, No. 10, 1977, pp 47, 51.

Amphidredge is basically pontoon with three or four hydraulically powered legs. Amphidredge can lift itself up and walk or paddle along. Vehicle can negotiate swamp and similar areas inaccessible to other vehicles. Normally fitted with hydraulic excavating arm but different versions might carry cranes or weed clearing equipment. Amphidredge can load itself on road-transport by raising itself on its legs and allowing truck to drive underneath.

A0021 "British-Built Suction Dredger of Advanced Design," Shipbuilding and Shipping Record, Vol 113, No. 23, Jun 1969, pp 773-774.

Sand and gravel suction dredger Hoveringham IV designed to carry load of 1300 tons of saturated sand at density of 17 cu ft/ton and can take on this load within 2 hr while stationary dredging at depth of 90 ft. Screens enable spoil to be discharged ashore in predetermined graded condition. Major features of self-discharging equipment and machinery described.

A0022 "Broadsweep Profiler Innovation," World Dredging and Marine Construction, Vol 13, No. 4, Mar 1977, pp 9-11.

Survey vessel "Profiler" equipped with new precision hydrographic survey system is described. Equipment will show small rock pinnacles or shoals which are often missed by conventional survey techniques.

A0023 "Bucket Dredger," British Patent No. 1495030, Dec 1977.

Invention reduces rate of wear on pivot pins of bucket chain on bucket dredgers. Arrangement reduces angular displacement around pins and therefore friction speed. Patent also describes pivot pin assembly comprising threaded spindle located in sleeves which fit into pivot pin recesses. Special pin lubricating system also described.

A0024 "Bucket Operations Electronically Monitored," World Dredging and Marine Construction, Vol 14, No. 3, Mar 1978, pp 36-38.

Crane position indication system described. System indicates position of grab bottom in relation to crane base.

C

A0025 "Centrifugal Pump for Processing Liquids Containing Abrasive Constituents, More Particularly, a Sand Pump or a Waste-Water Pump," British Patent No. 1439666, Jun 1976.

Centrifugal pump for liquids containing abrasives, more especially sand pump or waste water pump, includes means devised to eject heavier abrasive particles from front and rear wearing ring clearances in order to minimise abrasive wear in these regions.

A0026 "Combined Dredger/Oil Clearance Vessel," Meerestechnik Marine Technology, Vol 10, No. 3, Jun 1979, p 87.

Netherlands State Waterways Board (NSWB) owns Smal Agt which removes oil while floating on water surface. However it cannot deal with large spillages and is inoperable in winds of >force 3. Due to limitations, NSWB looking for spillage treatment ship 5 to 8 times larger than Smal Agt. Proposed vessel will have trailing suction hopper dredger with hopper capacity of 5,000 m^3.

A0027 "Contaminated Silt Removal Requires Special Equipment," World Dredging and Marine Construction, Vol 13, No. 12, Nov 1977, p 32.

Transportable cutter suction dredger designed to serve ecological needs described. Unit designed to remove contaminated sludge and silt from water bodies without releasing large concentrations of contaminants. Unit equipped with counter rotating high torque low speed reversible double cutters.

A0028 "Cutter Dredge Operational," World Dredging and Marine Construction, Vol 12, No. 12, Nov 1976, pp 22-23.

Article describes 12 inch discharge dredger designed to give high performance with light weight equipment. Provides working width of 16 by 40 feet and can self fold into unit 8 feet wide by 38 feet long for transport by truck.

A0029 "Cutter Dredging in Swell," Ports and Dredging & Oil Report, Vol 93, 1977, pp 16-19.

Problem of cutter suction dredging in swell conditions outlined. Problem compounded when dredging of hard material proposed. Present methods of cutter dredging examined and necessary modification to those methods stated. Article considers new design for walking cutter dredging platform intended for use in severe sea and weather conditions. WADSEP (Walking And Dredging Self-Elevating Platform) system described in detail.

A0030 "Cutter Suction Dredger Vlaanderen XIX - Power and Mobility," <u>Ports and Dredging & Oil Report,</u> No. 97, 1978, pp 6-8.

Vessel characterized by long forecastle, astern of which is large working deck. Dominant feature is crane track, situated at forecastle deck level and runs over entire length of ship. Traveling, revolving crane has hoisting capacity of 20 tons at reach of 16.5 meters.

D

A0031 "Dead and Dying Lakes Are Rescued by a Dredge with Chopper," Engineering News-Record, Vol 190, No. 21, May 1973, pp 18-19.

Revitalization of lakes dying from eutrophication by dredging was made by using portable hydraulic pipeline dredge that has ladder piston lift-crowd that gives down pressure far in excess of that obtainable by cable activated ladder. Chopper can move at maximum rate of 40 ft per minute through any type of organic material. Wheel mounted on 27-ft-long, hydraulically positioned boom that precedes cutter head on normal sweep.

A0032 "Deep Suction Dredging Installation," British Patent No. 1427954, Mar 1976.

Invention relates to suction dredging installation which operates at high solids flow rate, particularly from great depths. Two ships are used. First ship adapted to tow suction tube, to provide power for pumping device to remove dredged nodules, to store nodules, and pump nodules towards ore ships. Second ship tows material collecting device along sea bed, permits positioning of suction tube relative to first ship, and raises material collecting device in case of obstruction of suction tube, or for repair or replacing.

A0033 "D. E. Paterson," Holland Shipbuilding, Vol 23, No. 3, May 1974, p 205.

Trailing hopper suction dredger "D. E. Paterson" has length of 109.54 m, beam of 18.11 m, mean draft of 6.00 m, and hopper capacity of 2,830 m^3. "D. E. Paterson" operated in Durban harbour area on ship channel maintenance schedule involving trailing dredging along length of shipping lanes.

A0034 "Design Details of New Mineral Dredger," Ports and Dredging & Oil Report, Vol 93, 1977, pp 27-28.

Description of tin ore bucket dredger given. Design features patented ladder and ladder raising gear suspension system which allows optimum utilization of unit in prevailing wind and sea conditions. Incorporated in design are twin rotary screening drums, concentration plant and washing plant.

A0035 "Direct Drive Bucket Dredger," Dock and Harbour Authority, Vol 59, No. 692, Jul 1978, p 84.

First bucket dredger to utilize direct hydraulic drive for bucket chain completed. Dredger designed for working gravel deposits. Hydraulic motor gives steady pull on chain wheel and allows automatic control of chain speed in accordance with dredging terrain. Equipment can separate sand and ballast before discharge. Dredger designed for easy dismantling so it could be transported.

A0036 "Directory of World's Dredges," World Dredging and Marine Construction, Vol 15, No. 1, Jan 1979, pp 27-60.

Every dredge reported to editors listed: arrangement alphabetical by name of country - except for U. S., which is placed at end. Dredge information includes name, capacity, amount of horsepower, and type; ACE dredges also include name of each district. In several instances, brief description of company and/or names of management personnel included.

A0037 "Disc-Bottom Cutterhead: A New Development in Cutter Dredging," Holland Shipbuilding, Vol 27, No. 9, Nov 1977, p 44.

Disc-bottom cutterhead introduced consisting of cutter blades fitted between bottom plate and top ring. Advantages over crown-type or basket-type cutterheads include reduction of spill losses on order of 6-31%, achievement of very flat bottom profile, increased overdepth efficiency of about 5%, higher suction concentration, and less water pollution. Wide variety of applications anticipated. Standard series of disc cutter units to suit various dredger types planned.

A0038 "Double Walled Pump," Ports and Dredging & Oil Report, Vol 92, 1977, pp 17-19.

IHC Holland double walled dredge pump has proved considerably more resistant to wear than conventional single walled pumps. Forty-six pumps now in operation, and article compares operating and maintenance costs of these with conventional pumps.

A0039 "Draga D-7, A Straightforward Standard Trailing-Suction Dredger for Uruguay," Ports and Dredging, No. 70, 1971, pp 8-11.

Trailing-suction hopper dredge Draga D-7 has length of 92 m, and beam of 15.50 m. Single, 900 mm diam suction pipe fitted with drag head and of sufficient length to permit dredging to depth of 22 m mounted on starboard side.

A0040 "Dredger Cum Oil Spill Recovery Ship," Pollution Monitor, No. 47, Feb-Mar 1979, p 12.

Vessel designed with primary role as maintenance dredger but available 24 hr/d for dealing with offshore oil spills illustrated and discussed. Suction hopper dredger with hopper capacity of 5,000 m^3 is 8 times the size of special-purpose Smal Agt and can operate in open water in winds of more than force 3. In emergencies, dredger ceases operations, empties its hopper, and receives disaster team flown in by helicopter. Netherlands State Waterways Board considering vessel in lieu of investing in single-purpose spillage treatment ship.

A0041 "Dredge Recovers Coal, Creates Clear Lake," World Dredging and Marine Construction, Vol 11, No. 12, Nov 1975, p 71.

Auger-type cutting head attached to suction tube feeding into floating hopper (Mud Cut Machine) used to recover coal sediments from slurry silting pond. Machine propelled by winch and cable anchored on shore and moved across by lateral cables; can remove up to 18 in. of material on one pass and can continue to remove additional layers of material down to 15 ft below water level.

A0042 "Dredge Transport: Detailed Planning Needed to Accomplish Safe Ocean Tow," World Dredging and Marine Construction, Vol 14, No. 7, Jul 1978, pp 22-23.

Detailed planning of dry-tow transportation without cargo damage or loss described. Tugs, barges, and cargo handling and support equipment used in worldwide transport jobs. Some recent jobs named.

A0043 "Dredges, Ancillary Equipment Transported Safely by Barge," World Dredging and Marine Construction, Vol 14, No. 7, pp 27-29.

Ocean-going tugs combined with seagoing barges provide safe, efficient transportation for all cargo - especially for awkward-to-stow cargo - higher towing speed for dredging and offshore equipment, shallow draft capabilities, and single towage possibility for huge projects requiring many big objects. Transportation of 5 large cutter section dredges into shallow water of Richards Bay, South Africa, described. Other towages described.

A0044 "Dredges Expose Iron Ore," World Dredging and Marine Construction, Vol 10, No. 5, Apr 1974, pp 27-29.

Dredging operations to expose iron ore deposit beneath Bruce Lake in northwestern Ontario described. Work involves removal of 11.4 million cubic yards of muskeg-clay-silt overburden to depths of 100 feet.

A0045 "Dredging Apparatus," U. S. Patent No. 3990379, Nov 1976.

Marine dredging apparatus has a dredging aggregate that is connected to surface by means of a plurality of articulatedly interconnected rigid pipe sections that can be wound up on a prismatic reel that in turn is disposed on, in or around a vessel. To facilitate winding in a helical configuration, axis of prismatic reel is disposed at an angle to horizontal.

A0046 "Dredging Bucket," British Patent No. 1405050, Sep 1975.

Invention relates to dredging bucket cast in hard manganese steel with wear resistant working edge. Working edges of dredging buckets exposed to frictional abrasion, resulting defects being made good by welding on wear resistant materials. Steel compositions for bucket and edge teeth given. Use of invention should result in less maintenance and replacement expenditure.

A0047 "Dredging Heavy Soil with an Active Draghead," Ports and Dredging & Oil Report, Vol 96, 1978, p 18.

Active draghead principle explained. Draghead designed to enable trailing suction hopper dredgers to produce economically acceptable output when operating in consolidated soils such as clay.

A0048 "Dredging Method Employing Injection and Suction Nozzles," U. S. Patent No. 3646694, Mar 1972, Department of the Navy, Washington, D. C.

Patent relates to dredging method and apparatus employing high-velocity director injector nozzles which hydraulically dislodge and drive discrete bodies of large inertia from rest on aqueous floor into cooperating vacuum device which collects and removes them to another area for further treatment.

A0049 "Dredging Pipes," Ports and Dredging & Oil Report, Vol 88, 1976, p 23.

Article describes welded steel pipeline sections for transporting soil and water mixtures from dredgers as floating or shore pipelines. Standard lengths produced with fitting for either purpose.

A0050 "Dredging Plant," British Patent No. 1423315, Feb 1976.

Dredging apparatus has two shovels which face in opposite directions, and operate alternately. Invention based on fact that cables for adjusting attitude of shovels, which also serve for dragging submerged pump-dredging shovel unit, are inclined to vertical by angle which not only ensures precise adjustment of inclination of shovel concerned, but at same time ensures maximum efficiency of dredging and engagement of shovel with bed to be dredged.

A0051 "Dredging Pollutants. Different Techniques Used at Tunis and Osaka," Middle East Construction, Vol 1, No. 1, Jan 1976, pp 18-19.

Shallow, calm waters of Lake of Tunis involved lake-bed cleaning procedure very different to that of relatively open sea-waters of Osaka Harbour, although both procedures observe same parameter - absolute minimal disturbance of sea and lake bed. At Osaka, pneumatic dredging system capable of handling solids was adopted while for Lake of Tunis, suction dredging was used but with agitation of pollutant material confined within steel shield.

A0052 "Dredging Technology," Civil Engineering, Vol 70, No. 830, Nov 1975, p 34.

Article reviews 1st International Symposium on Dredging Technology. Author comments that material presented was practical rather than theoretical in nature. Work done to develop underwater remote control dredgers for applications such as harbour maintenance mentioned. Improvement of dredging operation efficiency by studying operation as whole and use of mathematical models allied to computer technology to predict rate of silt transport back to dredging area also discussed. Environmental pollution problem considered.

E

A0053 "Erosion by Moving Water Jets," Hydro Delft, Vol 39, Jun 1975, p 6.

Effects of variable jet pumping pressures and nozzle dimensions on loosening compacted material as preliminary to dredging studied with aid of test rig at Delft Hydraulics Laboratory. Possible applications for equipment of this kind as aid to dredgers of different types considered.

F

A0054 "Floating Dredger with New Hopper Discharge Technique," Deutsche Hebe und Fordertechnik (Export Issue), 1975/76, p 13.

Orenstein & Koppel Aktiengesellschaft received contract for construction and delivery of self-propelled hopper suction dredger. Dredger differs from conventional equipment in respect to loading and unloading systems developed by O & K shipyard. This assures high degree of loading efficiency and short discharge times by hydraulically reclaiming spoil.

A0055 "Flotation Ring for Dredge Pipe Lines," U. S. Patent No. 3992735, Nov 1976.

A hollow, flexible, two-sided, substantially C-shaped open ring which, when deflated, can readily be distorted for easy application in surrounding relation with respect to a length of dredge pipe, including strap means for temporarily securing the ring in place, and which when subsequently inflated, assumes a substantially circular cross-sectional shape and constricts radially to securely embrace the peripheral wall of the pipe for use in the flotation thereof.

G

A0056 "Giant Tin Dredge for TEMCO Dredging Offshore Thailand," World Dredging and Marine Construction, Vol 9, No. 5, Apr 1973.

Design features are given of tin dredge TEMCO-2 used by Thailand Exploration & Mining Company for tin mining in vicinity of Phuket Island, Thailand. Vessel consists of dredging section and ore dressing plant section arranged longitudinally. Dredge is equipped with ore dressing system called "jig plant" and hull with dredging equipment designed to match sea conditions off Phuket Island.

A0057 "Guarding Turbomachinery Aboard the 'Condor' World's Largest Dredge," Turbomachinery International, Vol 19, No. 8, Nov-Dec 1978, pp 15-16.

One of the largest hydraulic dredges that use gas turbines has emergency shutdown as well as temperature analyzing system which monitor data for troublefree operations. Classified as non-self-propelled vessel, the Western Condor sets ahead by using swing anchors to pull bow in port-to-starboard arcs, alternately raising or lowering two 100-foot spuds to provide off-center pivot at stern.

H

A0058 "HAM 211 Has 2,100 hp on Her Cutter," Ports and Dredging, No. 72, 1971, pp 12-13.

Cutter suction dredge 'HAM 211' has length of 97.20 m, beam of 14.50 m, and maximum suction depth of 23 m; total machinery output is 8432 hp, of which 2100 hp is used to drive cutter, suitable for working in rocky soil. HAM 211 can operate without spuds, equipped with 'Christmas Tree' anchoring system in which three wires are carried out from a point at stern beneath the waterline. One wire leads astern, the others outwards on the port and starboard sides, respectively. System is used when wave height exceeds 60 cm.

A0059 "High Torque Dredger Cutter Head Transmission," Shipbuilding and Marine Engineering International, Vol 101, No. 1217, Apr 1978, p 159.

Lohmann & Stolterfoht GmbH have developed special gear for cutterhead drives to operate in hard rock dredging conditions. Unit is described.

A0060 "Hopper Suction Dredge Delivered to Iraqi Port," World Dredging and Marine Construction, Vol 11, No. 13, Dec 1975, pp 38-39.

Second of two suction dredging vessels ordered by Iraqi Ports Administration has completed trials and is being delivered from Lubeck via Suez Canal to Basrah. Hopper can hold 3000 cu. m. with maximum weight of 4,350 tons; side suction dredging pipe enables dredging to depth of 27.5 m when vessel is empty. Details of mechanical and propulsion systems are included.

A0061 "Hydraulic Dredger on a Pile-Mounted Pontoon," Bautechnik, Vol 53, No. 4, Apr 1976, p A13.

New type of pontoon dredger is described, developed by Heinrich Hirdes GmbH of Duesburg, in collaboration with Orenstein & Koppel, Dortmund. Pontoon has three legs which can be hydraulically raised or lowered and driven into river bed as means of anchorage. Two legs are forward-mounted at one end of pontoon on either side of bucket excavator; the third is attached to carriage which runs in channel along pontoon midline in stern. When pontoon is to be repositioned the forward legs are raised and pontoon propelled backwards by hydraulic cylinder attached to rear leg with stroke of 2-3 metres.

A0062 "Hydraulic Research for Offshore Technology: Dredging and Trenching," Hydro Delft, Vol 40, Sep 1975.

Issue describes current problems dealt with by Delft Hydraulics Lab. Computation of wave forces on gravity structures, lattice-type structures and floating objects such as bucket dredgers and cutter-suction dredgers is discussed. Dredging trenches in shallow water may

be required when pipe-laying. Suitability of cutter dredgers for this work is discussed. Laboratory has also participated in design of flexible or swell-compensated spud- or ladder-suspensions.

A0063 "Hydrostatic Drives for Dredges Pioneered in Holland," World Dredging and Marine Construction, Vol 9, No. 1, Jan 1973, pp 16-22.

Hydrostatic cutterhead drives eliminate long drive shaft and provide space on ladder for submerged pump. Article describes various hydrostatic drive components. Bent axis motor was selected due to its capability to handle higher horsepower.

A0064 "IHC Beaver 8000 MP," Ports and Dredging & Oil Report, No. 95, 1977, pp 12-13.

Situated in ladder is underwater suction pump and associated electric motor. Twin dredge-pumps in pontoon are IHC double-walled type. Hydraulic power is used to raise spuds, actuate spud carriage, and drive winches. Hydraulic pumps are vane type. Power for inboard dredge pumps and engine cooling pumps is two Caterpillar tandem sets (4 × 1,140 hp). Third Caterpiller tandem set (2 × 863 hp) drives cutter generator and hydraulic pumps. Generator supplying current for motor which powers underwater suction pump is driven by Caterpillar diesel engine.

A0065 "IHC Slicktrail - A Trailing Suction Hopper Dredger/Oil Recovery Vessel," Holland Shipbuilding, Vol 28, No. 6, 1979, pp 64-65.

Design provides for vessel with hopper capacity of 5375 m. Features which distinguish this trailing dredger from others include: cofferdams surrounding hopper special pumps and oil/water separators in aft cofferdam; hydraulically operated deck machinery; flameproof electrical equipment in critical areas; extensive gas detecting installation; special fire-fighting equipment; foam installation for blanketing oil in hopper; accommodation according to IMCO Resolution 271; helicopter deck; and two oil recovery arms permanently stowed on afterdeck, each equipped with hydraulically driven pump and twin gantry for positioning.

A0066 "Improved Specific Gravity Measuring Means for Moving Slurries," British Patent No. 1414797, Nov 1975.

Invention relates to improved method of continuous measurements; in particular, it eliminates errors due to turbulence and uneven distribution caused by elbows. A U-bend is constructed in slurry delivery pipe, and each leg of "U" contains two pressure taps. Vertical distance between taps on upward leg is greater than between taps on downward leg. Differential pressure - a function of specific gravity - is measured by transducer connected between two cross pipes; one cross pipe connects upper taps on each leg of "U," the other connects lower taps. Arrangement eliminates errors due to friction. Patent describes method of selecting tapping point locations and a modified arrangement.

A0067 "Improvements in or Relating to a Dredger," British Patent No. 1476200, Jun 1977.

Three surface and a subsurface unit for deep sea dredger are described. Surface units consist of recessed floating vessel into which fits a recessed hopper barge into which fits in turn a push barge. Floating vessel is connected to subsurface unit by two parallel conduit arms attached and pivoted to vessel front and suspended at rear by winch cables. Subsurface unit is attached to one arm so that it travels along

sea bed in direction of surface units. Rotating bucket arm on subsurface unit disturbs silt which is sucked into a pump inlet positioned behind wheel and pumped to surface via conduit arm.

A0068 "Improvements in or Relating to Dredge Chains," British Patent No. 1467185, Mar 1977.

'Hinge type' drag chain for driving dredge buckets of endless bucket line is described. Advantage is that it enables chain-supporting system above dredge to rock while portions below remain in vertical plane during dredging.

A0069 "Improvements in or Relating to Dredging at Large Depths," British Patent No. 1470308, Apr 1977.

Patent describes dredging device for operating at variable and/or large depths. This comprises a carrier pontoon and dredging support structure consisting of variable number of interconnected sections of which one is always movable in vertical direction and mounted in guide device on carrier pontoon. Sections can be mounted one onto the other and when the structure has been lifted from operating position the pontoon center of gravity will not lie at undesirable level because superfluous sections can be dis-assembled. Flexible spoil line allows adaption to structure length.

A0070 "Improvements in or Relating to Sand and Gravel Dredges," British Patent No. 1418579, Dec 1975.

Object of invention is to achieve system for high speed delivery of cargo ashore in substantially dry state. Method of unloading ship's cargo of dredged sand and gravel is described. Cargo is decompacted and re-slurried by water under pressure, pumped to dewatering screens aboard ship and conveyed ashore after dewatering.

A0071 "Improvements in or Relating to Underwater Solids Collecting Apparatus," British Patent No. 1464549, Feb 1977.

Apparatus raises high density solids such as gravel in bulk from river bed or sea bed, particularly in depths beyond range of normal dredging equipment. Unit is hollow structure with two intakes situated on underside and outlet situated on topside. Air can be pumped into structure via a pipe creating an air-lift effect, thus causing material to be drawn into chamber via lower intakes. Solids settle into hopper reservoir in chamber floor. By closing top outlet and pumping air into structure, unit will rise to surface together with collected solids.

A0072 "Inductive Flowrate Indicator," Ports and Dredging & Oil Report, Vol 90, 1976, pp 22-23.

Article describes inductive flow rate indicator in which magnetic field is produced by electromagnetic coils surrounding measuring pipe. Two stainless steel diodes are incorporated in pipe wall, and passage of dredged material results in potential difference between them, producing measurable signal.

A0073 "'Inz. Marian Bukowski' Diesel Electric Trailing Suction Hopper Dredger Built for 'Navimor Foreign Trade Enterprise,' Poland," Holland Shipbuilding, Vol 24, No. 1, Mar 1975, pp 32-33.

Trailing suction hopper dredger "Inz. Marian Bubowski" has length of 72.80 m, beam of 12.90 m, and loaded draft of 5.60 m. Maximum dredging depth is 30 m and hopper capacity is 1600 m^3. Main engine output is 3440 hp and maximum speed is 11.5 knots.

A0074 "Jet Pump Dredge for Underwater Use," Dock and Harbour Authority, Vol 59, No. 696, Nov 1978, p 217.

Alluvial Mining has introduced submersible jet pump system for use by divers in clearance, maintenance, trenching and offshore mining operations. System can be used in depths to 300 m, can handle particles up to 150 mm, and has maximum output of 60 t/hr of sand when fitted with 30 m flexible suction pipe and 30 m discharge. It consists of tubular frame within which are mounted an electrically driven water pump, mixing chamber, diffuser, stilling tube, and suction and discharge ports. Unit weighs 1.5 t. It can hang suspended from vessel or stand on sea bed. Jet pump has mild steel body with wear resistant materials for mixing chamber and diffuser to permit abrasive materials to be dredged.

A0075 "Johanna Jacoba: A Hopper Dredger Equipped with IHC Active Dredgehead," Holland Shipbuilding, Vol 27, No. 3, May 1978, pp 60-63.

Johanna Jacoba has hopper capacity of 3,250 m^3 and is equipped with twin suction pipes of 750 mm diameter. It is able to dredge materials which until now were difficult or impossible to deal with by trailing suction. Vessel has airconditioned, ventilated, and heated accommodations for crew of 42 in nineteen 2-berth cabins and four 1-berth cabins. Particulars of vessel are: overall length, 104 m; molded breadth, 17.5 m; maximum draft, 6.23 m; laden speed, 12.8 kn; and tonnage, 3,772 GT. Two Lips controllable-pitch propellers are each driven through Vulkan high-elastic couplings by a Bolnes diesel engine type 16V-DNL 150/600 of 2,352 hp at 600 rpm. Vessel's generating plant is powered by two MWM diesels, type TBD 601-6K, each 432 hp at 1,500 rpm. Hopper contains 20 horizontally sliding bottom doors, a water-jet installation, self discharge system, and adjustable overflow system. Automatic draghead winch controller relieves dredgemaster of controlling swell compensator. Dredging equipment includes: 2 dredgepumps; self discharge system; automatic light mixture overboard system which allows only mixture with predetermined specific gravity to be loaded into hopper; and flowrate, concentration, production, and loading- and draft-indicators. IHC developed new type of dredge head incorporating rotating cylinder with knives. List of equipment and schematics of general arrangement are included.

L

A0076 "Largest Dredger Has Machinery Amidships," Marine Engineer and Naval Architect, Vol 94, No. 1141, May 1971, pp 190-192.

The 11,300 cu m hopper capacity dredger Vlaanderen XVIII has length of 124.0 m, beam of 27.0 m, draft of 9.6 m (full load) with corresponding dw of 16,350 t. Main machinery consists of twin diesel engines rated at 6,580 bhp at 525 rpm each driving both propellers and sand pumps. To assist in maneuvering, a branch is taken from the sand pumps and led down to the void aft of forepeak where a T-piece and hydraulically-controlled valves provide powerful bow thruster.

A0077 "Liverpool: Natural Scouring Exploited to Keep Channels Open," World Dredging and Marine Construction, Vol 14, No. 9, Sep 1978, pp 56-59.

River Mersey has 2 basins and falls as much as 30 ft between tides. Outer estuary with sandbanks and channels has presented challenge to dredging experts. Review of dredging operations from 1833 to Sep 1978 is presented. Problems of providing approach channel to port through sandbanks of Liverpool Bay was recognized during early 19th century. First dredging occurred in 1833 and continues today with maintenance of dock-river entrances supplied by grab hopper dredges. Dock system inside locks presents another area dependent on dredges. There are 3 main causes of silting of docks: impounding of silt laden river water; river water locked in each time lock is used; and leveling. Another problem is rubbish and other material which finds its way into the dock. Dredging in docks of Liverpool has been reduced because of phasing out of South Docks system which accounted for 30% of operations.

M

A0078 "Method and Apparatus for Collecting Mineral Aggregates from Sea Beds," British Patent No. 1405997, Sep 1975.

Apparatus is moved along sea bed, flattening surface of bed and forcing mineral aggregates into the silt. Upper layer of aggregates and silt is then sheared away and forced upward. Silt is washed away, and aggregates discharged to a pipe through which they are delivered to towing vessel or separate towed carrier.

A0079 "Method and Apparatus for Dredging Employing a Transport Fluid Flowing in Substantially Closed Recirculating Course," U. S. Patent No. 3975842, Aug 1976.

Dredging or suction of a soil suspension from the sea bottom is effected through a suction conduit connected with a suction head enclosure resting on the sea bottom, there concurrently being supplied to the suction head enclosure and through a separate conduit connected therewith a transport fluid under pressure. Transport fluid is separated from the soil suspension collected at the surface and recycled to the suction head enclosure. Thus the transport fluid flows in a substantially closed recirculating flow course and consequently pollution of the sea is lessened.

A0080 "Method and Apparatus for Excavating Settled Body of Solids," British Patent No. 1399189, Jun 1975.

Method is described for excavating and removing solid material such as contents of tailings pond containing waste mineral solids. Water jet is directed at material to form slurry which is then pumped away. Jet is then traversed to form an undercut cavity in material sufficient to cause overburden of material above cavity to collapse. Collapsed material is also formed into slurry and pumped away. Process is repeated with jet and pump equipment being lowered as material is removed.

A0081 "Method and Device for Sucking up a Solid Substance from a Stock," British Patent No. 1493503, Nov 1977.

Invention is intended for removing by suction one fraction of solid materials from materials consisting of several sizes and fractions and is presented as improvement to known designs. Suction pipe is inserted into solids to level below surface. Fluid is introduced via discharge nozzles located adjacent to suction pipe. By locating discharge nozzles at sufficient distance from suction pipe, invention allows only fluid containing required fraction to be acted upon by suction pipe. Auxiliary suction nozzles are provided to remove lighter material which is discharged elsewhere. Means of regulating specific weight of stream of required solids and water is also described.

A0082 "Modern Cutter and Trailing Suction Dredger Design," Marine Week, Vol 2, No. 17, Apr 1975, pp 59 and 63.

Author discusses development of centrifugal dredge pumps used on cutter-suction and trailing-suction dredgers, structure and operation of cutter-suction dredgers, determination of suitable design criteria, and use of trailing-suction hopper dredgers and hopper discharge systems.

N

A0083 "New, Adjustable Suction-Type Wheel Excavator," Ports and Dredging & Oil Report, No. 97, 1978, pp 4-5.

Principle of operation is that buckets are emptied by suction mouth which is in contact with bottom of bucket, which is open during and immediately after filling. Spoil is then transported with aid of dredge-pump and suction/discharge system. Three bucket bottom apertures are in contact with suction mouth, which is segmental in shape. The mouth angle can be adjusted to suit soil type and dredging depth. During tests, relevant parameters of dredging process and of wheel excavator were measured.

A0084 "New Bucket Dredge Delivered to Owner," World Dredging and Marine Construction, Vol 13, No. 11, Oct 1977, pp 36-37.

Designed to dredge in sea conditions with waves N80 cm high, bucket dredge Rhea was delivered to its owners, Ballast Nedam Group, the Netherlands. Dredge is nonpropelled type and capable of dredging on wires up to 25 m depth. Bucket chain drive and winches are electrically driven. Two sets of machinery are installed (1 is spare), each consisting of diesel engine through gearbox, coupled to constant current generator and ship's supply generator. Overall length is 58 m, and depth is 3.8 m. Two types of buckets are provided: 750-1 capacity for sand and mud and 400-1 capacity for rocks.

A0085 "New Digital Dredge Indicator," Holland Shipbuilding, Vol 26, No. 9, 1977, p 82.

Digital dredge indicator is designed around modern digital integrated circuitry to give high reliability for cutter suction dredgers under extreme conditions of vibration, temperature, and humidity. Linked with gyro compass, system maintains continuous visual indication of cutter-head position relative to channel heartline and water level. Accurate indication is sustained throughout movements of cutter ladder, spud, and dredge angle. Use of digital technology ensures system compatibility with future digital developments.

A0086 "New Dredging System for Gravel," Quarry Management and Products, Vol 4, No.7, Jul 1977, pp 177-182.

Suction dredging system shows higher efficiency than any known dredging system, being particularly effective in deep water. Dredger is capable of sucking up rocks up to 90% of intake tube internal diameter. Details are given concerning operation and use of unit.

A0087 "New Dutch Dredging Systems," World Dredging and Marine Construction, Vol 8, No. 1, Jan 1972, pp 20-21, 24-26.

Hopper discharge system consists of several longitudinally sliding valves which are linked to each other and actuated by single mechanism. Two rows of valves can be incorporated in a hopper. In addition to longitudinal opening and closing movements, each valve moves vertically over short distance and can be pressed against seal to give added watertightness. System is intended for incorporation into seagoing trailing-suction dredgers and hoppers and is suitable for hopper and dump barges.

A0088 "New Electronic Temperature Analysis Concept Guards Power on Western Condor," World Dredging and Marine Construction, Vol 15, No. 2, Feb 1979, pp 7-10.

Owned by Western Contracting Corp. of Iowa, Western Condor, world's largest gas-turbine-powered dredge, is 335 ft long with 42-in. diameter discharge. Power originates with 2 Model 592 gas turbines, each rated for 10,000 hp. Protection for complex power system comes from emergency shutdown network designed to accommodate potential hazards, e.g., excessive exhaust temperature, oil pressure loss, high oil temperature, overspeed, flameout, and vibration. Temperature analyzing system designed to provide operating and maintenance data was built around 2 state-of-the-art, microprocessor controlled instruments, Micro 8850, developed by Alnor Instrument Company. Each Micro 8850 tracks one turbine's operations by continuous scan of 8 exhaust-temperature thermocouple zones. Micro 8850 monitor increases in engine temperature and allows for effects of change. It is programmed for spread-limit adjustments from Lo Spread to Hi Spread and adjusted for control of activation of SPREAD alarm indicator. Data are presented to duty operator to compare actual speed performance with desired performance programmed in via thumbwheels. Separate alarm indicators alert operator for broken thermocouples. Diesels and generators are monitored by additional computer functions. The main dredge pump is powered by 6,300-hp motor.

A0089 "New Equipment Improves Dredging Procedures," World Dredging and Marine Construction, Vol 13, No. 6, May 1977, pp 30-34.

Article considers new technology and equipment being applied to dredging operations and mentions achieving remote control of dredging operations from wheel house in trailing suction hopper dredges. One-man control console for cutter suction dredges featuring various measuring instruments is also described. Spud operations can be facilitated by use of spud ring position meter and dredge depth meters. Also mentioned is measuring equipment for stress analysis.

A0090 "New High-Pressure Slurry Pump Design Starts Up at Florida Phosphate Mine Pipeline," Pit and Quarry, Vol 69, No. 9, Mar 1977, pp 76-77.

First installation of Georgia Iron Works Co. dredge type pump with high pressure design is operating successfully at phosphate mine in Florida. Pump boosts slurry pressures from approximately 90 psi to 200 psi to send phosphate matrix slurry from mine pit pump to processing plant.

A0091 "New Machine Cuts Offshore Trench Through Boulder Clay," Oil and Gas Journal, Vol 71, No. 3, Jan 1973, p 56.

Trenching machine for burying up to 60 in. dia offshore pipelines in boulder clay is Ponga, submersible cutter dredge with depth capability of 200-500 ft and cutting capability of 700-800 cu yd/hr when handling fluidized solids at solids-water ratio of 1:6. Trencher is pulled by winch on service barge and is kept on correct route by groups of neoprene rollers on main structure, hydraulically adjusted to conform to pipe contour. Ponga was tested on stiff clay bottom with a shear strength of over 2500 lb/sq ft and operated at about 3.5 ft/min, digging ditch 12 ft wide at the top, 6 ft wide at bottom, and about 8 ft deep.

A0092 "New Method of Dredge Pump Reclamation," International Dredging and Port Construction, Vol 5, No. 1, Oct 1977, pp 13, 15 and 16.

New method of reclaiming worn dredge pump casings by welding in of precision castings to replace the metal eroded is described, and advantages claimed for system are listed.

A0093 "New Self-Discharge System for Trailing Suction Dredges," World Dredging and Marine Construction, Vol 5, No. 10, Nov 1969, pp 24-25.

Investigations and model and other tests resulted in self-discharge system in which water flow moves at right angles to longitudinal axis of hopper. Flushing and self-discharge ducts were positioned outside confines of hopper. Model hopper constructed for tests was separated into two equal compartments by longitudinal bulkhead, longitudinal self-discharge system and transverse system.

A0094 "New Vessels," Holland Shipbuilding, Vol 27, No. 11, Jan 1979, pp 23-31, 34-35.

Information is presented on stationary cutter-suction dredger H.A.M. 218; self-propelled, multi-purpose crane ship Uglen; LPG carrier M/V Berge Sisu; and multi-purpose, deep-sea RO/RO ship M/V Boogabilla. Machinefabriek Vos and Zonen B.V. built the H.A.M. 218 for Hollandsche Aanneming Mij. (H.A.M.) B.V. Two Bolnes diesel-engines with a total output of 6450 hp supply power for 3 generators. Principal particulars include length, 71 m; breadth, 16.5 m; draft, 5.50 m; hp, 14,150; pipeline diameter, 850 mm; and 3 VOS dredgepumps.

A0095 "New Vessels," Holland Shipbuilding, Vol 28, No. 1, Mar 1979, pp 42-47.

70-m single screw ocean-going trailing suction dredger Anton Musing has breadth 9.45 m, draft 3.55 m, hopper capacity 850 m^3, cargo capacity 1,440 t, weight 1,300 t, speed 11.5 kn, and is powered by Bolnes diesel type 6 DNL 150/600 with continuous output 900 hp at 600 rpm. Two 52.75-m self-propelled split barges Mark and Vliet are twin-screw types and completely welded with combined longitudinal and transverse framing. Each vessel has breadth 9.05 m, depth 3.35 m, draft

3 m, hopper capacity 450 m^3, speed 9 kn, and is powered by 2 Caterpillar type 3408 TA marine diesels, each with output of 370 hp at 1,800 rpm continuous. Deck and nautical equipment and other particulars are presented.

A0096 "No. 3 Suez-8,000-ps Cutter Suction Dredger," Zosen, Vol 21, Oct 1976.

Horsepower (PS) quoted in title is that of electrically-driven dredge pump of non-self-propelled dredger, which is assisting in deepening and widening of Suez Canal. Dredge was designed for coastal, river, and harbor work in rock beds as well as soft mud and coarse sand and has been equipped with Suez Canal service particularly in view. Dredge has two spuds (stowable on upper deck) and "Christmas tree" mooring system. To assist dredge pilot in maintaining vacuum, ejector is provided within suction ladder.

A0097 "Novel Plant for Dredged Sand," Quarry Management and Products, Vol 2, No. 8, Aug 1975, p 211.

Article describes sand processing plant at riverside operation in England.

O

A0098 "One Amphibian Digs at a Canal...Sea Dump--an Amphibious Dredger," New Scientist, Vol 80, No. 1125, 1978, p 180.

Sea Dump built by Sonerud of Sweden, is half boat and half wheeled vehicle and is finding applications in shallow-water dredging. Pontoon-shaped vessel is 'boat-half' of Sea Dump and houses both hydraulic power-unit and operator's controls. A 76 hp diesel engine drives hydraulic pump which supplies power for propulsion steering and dredging equipment. Speed is 4 knots in either direction. Dredging equipment is mounted on steel frame positioned between two large rollers in front of vessel. Roller farthest from pontoon is powered and is fitted with ridges to enable adhesion to soft surfaces allowing dredger to work on shelving beaches and to mount banks. Dredging support frame is articulated to allow rollers to support it on inclined surface. Position of rollers in relation to frame, and thus dredging depth, is controlled by hydraulic rams. On support frame is hydraulic grab bucket that can lift about 40 cu ft of earth in one dredging which is dumped in deep water or on beach for removal. Wheels at back of Sea Dump are for helping to load vessel onto lorries or trailers.

A0099 "Ongoing Evolution in the Dredge Design Pays Off for World's Placer Miners," Engineering & Mining Journal, Vol 178, No. 6, Jun 1977, pp 174-180, 184.

One method used to mine placer deposits is dredging, defined as underwater excavation of placer deposit by floating equipment. Article gives summary of minerals that are mined by dredging and reviews improvements in dredge design. Features of world's largest dredge, commissioned for mining large, low-grade tin deposit, are described, and patented dredge designs for both bucket-line and suction dredges are outlined.

A0100 "Oranje, First Self-Propelled, Seagoing Cutter Suction Dredger Delivered to The Royal Bos Kalis Westminster Group N. V.," Holland Shipbuilding, Vol 27, No. 7, 1978, p 33.

Vessel has oa length of 132 m, total installed power is 19,000 hp, and speed is 10 knots. Dredge discharge pumps are diesel driven through a gearbox. Cutter is powered by two electric motors, each with output of 1,800 hp placed below in cutter ladder. Inside diameter of suction line is 850 mm and discharge line, 800 mm. Vessel is equipped with spud carrier with main and auxiliary spud, anchor boom, and christmas tree installation.

P

A0101 "Pipelaying in the Tidal Zone," <u>Pipes and Pipelines International,</u> Vol 20, No. 3, Jun 1975, pp 19-21.

When laying pipe, siltation problems occur in trench. Methods have been developed to overcome problem, including sheet piling and pipeline burial devices. Heavy dredging plant can also be employed to create sufficiently extensive excavation and thus counter siltation problem. To overcome problem of maintaining trench profile in tidal zone, access jetty has been constructed to allow installation of sheet piled cofferdam alongside trench route.

A0102 "Pneuma Pump System Reduces Chances of Secondary Pollution," <u>World Dredging and Marine Construction,</u> Vol 11, No. 12, Nov 1975, pp 57-61.

Use of Pneuma pump system for removal of polluted bottom sediments without danger of simultaneous transfer to adjoining non-polluted areas is described. System employs bank of 3 chambers mounted on harbor bottom which can be filled with bottom sediment under hydrostatic pressure and emptied through pipeline to surface vessel by means of compressed air.

A0103 "Portable Dredge Conserves Limited Space for Settling Basins," <u>Chemical Processing,</u> Vol 41, No. 10, Sep 1978, p 38.

Settling ponds were too large for drag line to be practical, had too many branches and narrow channels for conventional barge, and had filled in to depth N2 ft. Portable dredge, powered by 175-hp diesel engine, is moved from side to side by pullover cables anchored on shore and cuts N18 in. of sediment on each pass of its 8-ft-wide auger to 15 ft depth. Auger assembly at end of hydraulically operated boom is lowered into water during operation, turning and forcing waste material into intake tube. Material is then pumped through discharge pipe to designated disposal area.

A0104 "Portable Jet Suction System Replaces Dredge at Caland," <u>World Dredging and Marine Construction,</u> Vol 12, No. 9, Aug 1976, pp 24-27.

Article describes Marconaflo slurry system which consists of portable 1000 GPM Caisson unit and "Dynajet 1000," both crane supported. Booster pump transfers slurry to its settling ground. Account is given of Marconaflo's development and patenting of Marconajet, which delivers both energy and liquid medium to transform dry, compacted materials into slurry.

A0105 "Position Fixing Systems," <u>World Dredging and Marine Construction,</u> Vol 15, No. 3, Mar 1979, pp 16-18, 20.

Tellurometer's MRD 1 which uses established Tellurometer microwave phase comparison measuring principle is nearly a totally automated position fixing system. Master instrument's integral microcomputer simplifies fixing operations and connection of ancillary equipment. No tuning or calibration is required. It does not suffer signal loss caused by passing large vessels nor false range readings caused by signal reflections from obstructions. Instructional information is entered on simplified keyboard, which simplifies operating control of peripherals. It offers standard multiplex option permitting N6 vessels to operate from shared remote units. No high-powered microwave pulses are emitted, so no health problems are posed. Decca Survey Limited's Offshore Acoustic/Satellite Integrated System (OASIS) is position fixing system which has minicomputer-controlled integration of Aqua-Fix/2 acoustic positioning and Sat-Fix satellite positioning systems, with highly advanced software. System operation, which consists of navigation to location, laying and calibration of net of 3-5 acoustic transponders, and positioning using net, is briefly described.

A0106 "Positioning and Track System Aids Dredging," World Dredging and Marine Construction, Vol 13, No. 4, Mar 1977, pp 12-14.

Device to assist dredges in positioning and keeping track of areas already worked is Trisponder/X-Y Plotter System. Designed specifically for dredging industry, system utilizes latest advances in microprocessor technology in plotter drive unit and can accept range-range inputs from other positioning systems with compatible 8-4-2-1 BCD output. Used in conjunction with line of sight positioning system, X-Y plotter system allows dredgers 24-hour-a-day operation in fog, rain, or darkness.

A0107 "Positioning Systems," Civil Engineering (London), Vol 70, No. 830, Nov 1975, p 31.

Article describes high accuracy microwave electronic position fixing system designed for hydrographic applications. System has been used in North Sea and has role in pre- and post-dredging survey work.

A0108 "Powerful Cutterladder Constructed by Shipyard Stapel," Holland Shipbuilding, Vol 24, No. 5, Jul 1975, pp 34-35.

To meet demands for greater depths and more powerful equipment for entrance channel dredging, Shipyard Stapel of Holland constructed huge cutterladder with 36 m total length, 400 ton weight, and 6 m high rear end. Maximum cutting depth of ladder is 25 meters, and long suction line necessitated installation of all machinery on ladder itself. Suction pipe has 850 mm diameter. Ladder is equipped with rock cutter which weighs 13 tons.

A0109 Proceedings, Eighth Dredging Seminar, Texas A&M University Center for Dredging Studies, 1976.

Papers presented include: physical factors affecting dredged material islands in shallow water environment; new concept for dredged

material disposal; dredging operations in Galveston District; dredge material containment in nylon bags in construction of mini-projects for beach stabilization; Houston-Galveston vessel traffic system; national dredging study; investigation of environmental impacts associated with dredged material disposal at offshore disposal site, Galveston, Texas; remote sensing in evaluating turbidity plumes; hydrologic and sedimentologic study of offshore dredge disposal area, Savannah, Georgia; and aquatic disposal of dredged material and release of contaminants during and after disposal.

A0110 Proceedings, Fifth Dredging Seminar, Texas A&M University Center for Dredging Studies, 1972.

Papers presented include: Dredge Hulls--Construction and Reconstruction; Economic Justification for the Use of a Fully Lined Dredge Pump; The Offshore Dredge--A Solution to Beach Restoration; Soil Mechanics Applied to Dredging; Bartaw Maintenance Dredging and Water Quality; Corps of Engineers Dredging Operations in Galveston; Present Status of Spoil Disposal Areas Along the Houston Ship Channel; and Offshore Dredging Problems.

A0111 Proceedings, First International Symposium on Dredging Technology, BHRA, 1975.

Theoretical and practical aspects of dredging are covered including equipment, economics, and performance. One paper explores economics of dredging sand and gravel for aggregate, while another compares spoil disposal methods. Transportation problems are discussed, particularly in hydraulic pipelines, as well as abrasion resistant alloys for pumps and siltation in dredged channels. Other topics include estimation of need yield measurement parameters spoil disposal, dispersion, loading, and dewatering.

A0112 Proceedings of the World Dredging Conference, WODCON IV, 1971.

Papers presented under the theme "A Salute to the Dredging and Marine Construction Industry of North America" include dustpan dredge; total concept approach to rebuilding pump shells; estimation of design data for transportation of solids in horizontal pipe lines; airlift systems for mineral recovery in ocean mining; explosives as tool for marine construction; deep dredging by jet-ejector dredger; metallurgical quality control for dredge cutter parts; leveling equipment for rubble mounds; on-board sewage treatment systems; environmental considerations for estuarine dredging operations; state regulation of dredging; and slurry flow in small diameter vertical pipes.

A0113 Proceedings of the World Dredging Conference, WODCON VIII, 1978, Central Dredging Association, Delft, Netherlands.

Articles are primarily concerned with dredging and associated vessels. Specific design considerations are described for offshore structures and comparable equipment.

A0114 Proceedings, Second Dredging Seminar, Texas A&M University Center for Dredging Studies, 1969.

Papers presented include: pollution control and dredging; the McFarland, 2-1/2 years after; effect of air content on dredge pump performance; Hofer system; dredge pump and pipeline energy losses; and cavitation in dredge pumps.

A0115 Proceedings, Second International Symposium on Dredging Technology, 1977, BHRA, Cranfield, Bedford, U.K.

Summaries of papers presented at symposium are given. Topics discussed include economics and port investments; international dredging contract conditions; hydrodynamic and geometric parameters of shells as dredge material; fine sediment studies relevant to dredging practice and control; maintenance and regulation of navigable channels by submerged contractions; design, construction, and response of new barrier island tidal inlet; influence of cutterhead ht of dredge production; electronic 3-D-positioning of dredge head to improve economy of bucket-and-cutter dredge operations; new generation of dragheads for hopperdredge; technological gaps and environmental effects of marine mining; trenching in granular soils; experimental development of jet bedding techniques for marine structures; productive land use of dredged material; disposal site selection in Rhode Island Sound as determined by research submersible and scuba surveys; potential impacts of deep ocean dredged material disposal; dewatering of confined dredge spoil areas; engineering considerations in dewatering and reclamation of fine grained dredge material; dredging-induced modifications to sediment texture and their influence on beachfill requirements; erosion of dredged-material islands due to waves and currents; threshold erosional velocities and erosion rates for redeposited estuarine dredge materials; application of analytic model to stationary-deposit limit in sand-water slurries, integrally floated flexible pipeline for use with cutter/suction dredgers; and computational methods to model unsteady, variable density flows in hydraulic dredging.

A0116 Proceedings, Third Dredging Seminar, Texas A&M University Center for Dredging Studies, 1970.

Papers presented include: Particle Size and Density Effects on Cavitation Performance of Dredge Pumps; Materials Used in the Manufacture of Dredge Pumps; Research Needs of the Dredge Pump Manufacturer; Report of WODCON 70; Slurry Flow in Vertical Pipes; and Water Quality in the Dredging Industry.

R

A0117 "Radio Relayed Tidal Data Assures Accurate Dredging Depth," World Dredging and Marine Construction, Vol 14, No. 3, Mar 1978, pp 34-36.

Article describes how tidal reporting system allows dredging operators to adjust for rising or falling tides.

A0118 "Range Positioning System for Dredging and Surveying," Undersea Technology, Vol 13, No. 3, Mar 1972.

Motorola's Government Electronics Division has developed the Range Positioning System (RPS) Survey System for use in surveying and dredging operations. Using two X-band transponders located on shore and an X-band interrogator located on the vessel, X-Y position coordinates are determined by triangulation based on elapsed time between interrogator and reference transponders. System is accurate to within 10 feet at 50 nautical miles. For dredging operations system provides electronically controlled steering indicator to enable the vessel to stay on course without using shore markers. RPS also continuously calculates and records position and water depth and can cross-hatch areas along survey line where water depth is less than predetermined minimum. Data are supplied to interrogator via calculator-type keyboard on console or cassette tape supplied by survey group.

A0119 "Revolutionary Dredge Is Being Built in the Netherlands," Marine Engineering/Log, Vol 84, No. 2, Feb 1979, p 19.

Stevin 80 is new dredge that its makers say can handle marine mining and harbor building operations previously stymied by rough wave and soil conditions, high seas, and rocky ocean beds. Prototype of the dredge is under construction at cost of $100 million, is 623 ft long by 220 ft wide, weighs about 29,000 tons, and was scheduled to be ready for use by 1979. Designers claim new dredge makes it possible to design and build ports in locations previously considered unrealistic because of adverse conditions and add that dredge will allow harbor dredging without waiting for construction of breakwaters. It could open up new possibilities for pipeline trenching in rough coastal waters and for coastal mining.

A0120 "Rubber Mounting Flanges," British Patent No. 1453999, Oct 1976.

Flange for mounting large armored rubber hose, for example, in suction or pressure duct of suction dredger, on a pipe is described. Layers of armoring continue into flange. At least one annular metal lamina is attached to each armoring layer in flange region so that armoring cannot yield substantially. Lamina nearest flange face is thicker than rest and extends to inner base of flange, so that it forms support plate to prevent flange lifting off at inner bore. Flange is coated with rubber to protect it against external damage, and load plate is

vulcanized to back to spread load and prevent bolts biting into rubber coating. Raised annuli on sealing face improve resistance to penetration by conveyed material. Further advantage is that bolt holes may be drilled through entire assembly using conventional twist drills.

S

A0121 "Semi-Submersible Dredge that Walks Through Surf," Ocean Industry, Vol 14, No. 2, Feb 1979, pp 97-101.

Stevin 80, world's first semisubmersible, walking cutter suction dredge, was designed to cut very hard material under severe wave conditions and can work along most of world's coasts where waves are about 8 ft. When vessel is standing, center of rotation of cutter ladder is independent of wave action. Legs are positioned behind slope of dig for stability. Four standing legs, 4 walking legs, and a controlled ballasting and deballasting system have eliminated need for anchors. Hard material is discharged through pipe via stinger at 2,000 m/hr; soft material is discharged through boom at rate of 3,000 m/hr. Forward motion and transverse motion of platform are discussed. Dynamically positioned split barges with 3,000-m^3 capacity have been designed to work with new unit.

A0122 "Semi Submersible Dredging," British Patent No. 1468191, Mar 1977.

Patent describes semisubmersible dredging method to solve problems associated with heavy materials mining in sandy type deposits on continental shelves or metallic nodules on deep sea floors. Semisubmersible shell is used, inside of which is kept at atmospheric pressure. Material is sucked in from outside shell as result of flow in intake pipe caused by difference in pressure between inside of shell and outside. Water is separated from solids which are deposited in a reservoir before being transported to surface by ladder buckets.

A0123 "Sir Thomas Hiley Australian-Built Dredger," Shipping World and Shipbuilder, Vol 164, No. 3857, May 1971, pp 529-532.

The 4100-t dwt trailing suction side dredger Sir Thomas Hiley has a length oa of 320 ft, beam of 54 ft, draft (loaded) of 18 ft and is powered by diesel electric system of propulsion, which also supplies main dredging machinery. Main diesel prime movers comprise three English Electric-Ruston 9-cyl, turbocharged, type 9ATC engines developing 2460 bhp at 600 rpm giving speed of 12 knots.

A0124 "Small Dredge Does Big Job," Roads and Streets, Vol 117, No. 9, Sep 1974, pp 26-27.

Small dredge is fastest and quietest way of deepening small lake. Quiet and unobtrusive operation of excavating equipment was essential since 11-acre Lake Hinsdale was in densely populated prestige condominium development near Chicago. Material being removed is hard, rocky clay and pockets of silt, peat and organic materials.

A0125 "Special Ships Profile: Al Wassal Bay: Suction Dredger," Special Ships, Vol 2, No. 7, Jul 1979, pp 29-30.

Propulsion for world's first self-elevating heavy duty offshore cutter suction dredger is provided by four 750-rpm, 1600-hp Yanner diesel engines, monitored and controlled from central engine control room. Principal particulars are included.

A0126 "Special Vehicles Conquer Heavy Mud," World Dredging and Marine Construction, Vol 13, No. 8, Jul 1977, p 28.

Article considers use of tracked amphibious personnel and cargo carrier for transporting people and equipment to dredgers in marshy and muddy lowlands. Also described is heavy duty cargo and personnel carrier called 'wheel buggy.'

A0127 "Split-Hull Hopper Dredge Manhattan Island Ready for Service," World Dredging and Marine Construction, Vol 13, No. 10, Sep 1977, pp 21-23.

Basic components of the high pressure hydraulics system of the dredge are hinges which hold 2 longitudinal half sections together and 2 hydraulic rams which function as opposing force, preventing sudden impact during opening or closing of hull. Principal particulars include overall length, 281 ft; molded depth, 211/2 ft; loaded draft, 191/2 ft; beam, 52 ft; and hopper capacity, 3,600 yd^3.

A0128 "Stainless Steel Dredge Made to Last," World Dredging and Marine Construction, Vol 12, No. 12, Nov 1976, pp 18-19.

Article describes design and construction of suction dredger for excavating solid chemical residue from cooling water pond with pH of 1.5. Low carbon stainless steel was used for the structures coming into contact with water, and stainless steel workboat with 9 foot maximum dredging depth was built.

A0129 "Standard Machinery in a Dredger Fleet," Marine Engineer and Naval Architect, Vol 93, No. 1127, Feb 1970, pp 61, 63.

Six hopper dredgers and six hopper barges ordered by Anglo-Dutch consortium will have total of 68 Dorman engines with same cylinder dimensions. These 5000 dwt ships have triple Seffle-cp propellers, each driven by Dorman 120TCWM 12-Vee turbocharged and charge-cooled engine of 827 bhp at 1800 rpm through 4.5 to 1 Lohmann reduction gear box. Pump room is amidships and contains two 800-hp dredging pumps drawing through 800-mm suction tubes fitted with pressure jets at head. Maximum dredging depth is 25 m. The six hopper barges have two Dorman 8OTCWM Vee-8 turbocharged and charge-cooled engines rated 1000 bhp at 1625 rpm driving propellers through 4 to 1 reduction gear boxes. Auxiliary electrical services on both dredges and barges are provided by Dorman diesel generators. Principal particulars are given with details of general arrangement and machinery.

A0130 "Standard Studies Plastic Pipe Use," World Dredging and Marine Construction, Vol 12, No. 6, May 1976, p 38.

Plastic pipe in sand dredging operations was tested on Mississippi roadbed project. Advantages of using this type of flanged high density polyethylene pipe are discussed.

A0131 "Stone Dump Barge," World Dredging and Marine Construction, Vol 12, No. 5, Apr 1976, p 17.

Self-propelled seagoing stone dump barge is designed for carrying rocks and stones to dumping sites at sea and is suitable for moving sand, mud and gravel on ocean and inland waters. Split barge is 60.82 meters long, 11.85 meters molded breadth, 4.75 meters molded depth, with an 800 cubic meter hopper capacity. Both halves of the barges are hinged at the upper deck level. Cargo is dumped by pushing two halves apart through four hydraulic cylinders mounted under deck.

A0132 "Suction Cutterhead Dredges Aid in Mining Operations," World Dredging and Marine Construction, Vol 10, No. 5, Apr 1974, pp 30-31.

Case studies describing use of custom-built hydraulic pipeline cutterhead dredges in mining and aggregate operations are presented. Production problems in alluvial tin mining operation in France were solved through use of hydraulic pipeline cutterhead dredge.

A0133 "Suction Dredgers," British Patent No. 1405234, Sep 1975.

Suction dredgers for operating underwater consist of lengths of rigid piping pivotally connected by universal joints formed by hinge parts and connecting members and communicating with each other by flexible bellows arranged side by side at the area of one universal joint. Object of invention is to reduce bulk and hence weight and cost of hinge. Duct system comprises tubes which communicate with each other at hinge areas through branch tubes and bellows arranged between branch tubes. Each hinge comprises fork shaped hinge parts rigidly secured to opposed ends of adjacent tubes and acting by means of journal bushes in a pivotal manner on pins of cross-piece forming coupling member.

A0134 "Suction Dredger with Swell Compensation," U. S. Patent No. 3893249, Jul 1975.

Tension load on cable suspending the nozzle and conduit of earth suction dredger is reduced by employing reversing sheaves at nozzle with multiple cable passes thereover. In order to 'sling' nozzle end pulleys or sheaves and avoid movement between slinging cable portions and nozzle end pulleys as swell compensation is effected, slinging pairs of cable portions are guided and maintained side-by-side and are acted upon in unison by swell compensation device.

A0135 "Suction Head Winch Controlled," World Dredging and Marine Construction, Vol 12, No. 4, Mar 1976, pp 40-41.

Automatic suction head winch controller has been developed to keep swell compensator in midway position so suction head is pressed on bottom and optimum production is achieved.

A0136 "Suction of Sand," Hydro Delft, Vol 39, Jun 1975, pp 9-10.

Small scale tests at Delft Hydraulic Laboratory have shown how bed sand movement is affected by suction pipe penetration moving either vertically or horizontally. Shape of cavity created has been related to mechanical stresses and pore pressure within sand. Direct action of suction tube is limited.

T

A0137 "10,000 m^3 Capacity Humber River, First Steps Towards Computerized Dredging," Motor Ship, Vol 52, No. 615, Oct 1971, pp 311-312.

Trailing twin arm hopper suction dredge Humber River has length of 130.30 m, beam of 22.50 m, and is particularly notable in engine room arrangement, which is centered around the first vee-type Stork-Werkspoor TM410 engine installation to go to sea, each developing 8000 bhp at 500 rpm giving loaded service speed of 15 knots. Engines are arranged to drive dredge pumps, water jet pumps, and shaft alternators. Layout involves entensive system of gearboxes, clutches, couplings and power take-off shafts. Hopper capacity is 10,000 cu m.

A0138 "Tests with 'Active' Draghead," Ports and Dredging & Oil Report, Vol 91, 1976, pp 10-11.

Article describes tests on active draghead on trailing suction hopper dredge, designed for dealing with hard or compacted soil. Craft used was designed for testing dredging systems and dredger components.

A0139 "The Cutting of Soil Underwater," Hydro Delft, Vol 39, Jun 1975, pp 2-3.

Behavior of sand and clay soils in response to shearing force is discussed with reference to forces encountered during dredging of these materials and behavior of cutting edge.

A0140 "The Latest Dredge Technology from IHC Holland," Holland Shipbuilding, Vol 28, No. 8, 1979, pp 86-91.

Article examines three new types of dredges: (1) IHC Splittrail Pantagruele which is the first large trailing-suction hopper dredger, (2) six IHC Beaver cutter suction dredgers bought by Peoples Republic of China, and (3) semi-submersible dredge. Concept for last one is discussed in detail.

A0141 "The New Dredging Generation Semi-Submersible Cutter Dredger," Holland Shipbuilding, Vol 27, No. 1, Mar 1978, pp 48-49.

Semi-submersible walking cutter suction dredger system is designed to dredge hard soils even in heavy swell conditions. Unit has minimum dredging depth of 3 metres and maximum depth of 32 metres and, when working at 32 metres, can cope with maximum wave height of 3-4 metres.

A0142 "The 'Slicktrail' Dredger/Anti-Pollution Vessel," Shipping World and Shipbuilder, Vol 72, No. 3958, 1979, pp 758, 761.

Design provides for vessel with hopper capacity of 5375 m^3. Features include cofferdams which surround hopper special pumps and oil/water separators in after cofferdam hydraulically operated deck machinery, flameproof electrical equipment in critical areas, extensive gas

detection apparatus and fire-fighting equipment, foam installation by means of which gas which may form above oil in hopper can be blanketed, accommodation which conforms to IMCO Resolution 271, and helicopter deck. Oil recovery installation comprises two sweeping arms which are permanently stowed on afterdeck and can be used in waves of between 1.0 and 1.5 m. When needed, arms are hoisted overboard by means of twin gantries and placed in operating position forward. The vessel's speed during oil clearance operations is approx 2 kts. At 50 m sweep width, this implies clearance of area of 180,000 m^2/h. Each sweeping arm is equipped with twin hydraulically driven centrifugal pumps. Each pump has capacity of 500 m^3 of water per hour at pressure of 3.5 bars. For oil which has viscosity of 900 cST, volume pumped is 360 m^3 (at 3.5 bars). Depending upon operating conditions, oil content of the pumped mixture may be up to 80 percent.

A0143 "Twelfth Annual Directory of Dredges and Suppliers," World Dredging and Marine Construction, Vol 14, No. 1, Jan 1978, pp 20-D19 - 20-D97.

The directory documents trends of dredging industry, provides service to dredging and allied industries, encourages communication of technical information on dredge equipment and operations within industry, and contributes to advancement of dredging technology in cooperation with World Dredging Association and World Dredging Conference. World dredges are listed by length, hp, and type, by country and company, including company's address. Names and addresses of companies providing equipment and services to dredging industry are listed, and the names only of companies supplying equipment and services to industry are listed by equipment or service they furnish. Types of world dredges listed include trailing suction hoppers, suction hoppers, grab hoppers, hopper barges, cutter suctions, suctions, floating grab/clamshell, dippers, booster stations, suction dustpans, and bucket backhoes.

U

A0144 "Underwater Excavating Apparatus and Method," British Patent No. 1480266, Jul 1977.

Dredging machine comprises forward floatable dredging section and rear floatable tail section connected by intermediate hull section. Dredging section pivots in arc relative to tail section while machine is anchored by spuds on rear section. Once dredging in arc has been completed, dredging section can be moved forward by increments relative to anchored tail section by means of extension system. Once maximum extension has been reached dredge cutterhead support section is anchored by spuds and tail section can be unanchored. Tail section can be drawn back relative to dredge cutterhead support section. Tail is then anchored and dredging section unanchored allowing whole process to be repeated.

V

A0145 "Vacuum and Pressure Indicator," Ports and Dredging & Oil Report, Vol 86, 1975, pp 26-27.

Article considers dredge pump vacuum and pressure indicators produced by IHC Holland. Operation principle of indicators is given.

A0146 "Versatile Italian Dredge Pump System," World Dredging and Marine Construction, Vol 7, No. 11, Oct 1971, pp 39-41.

Compressed air dredging system developed in Italy can operate from a land base as well as from pontoon or barge, can be adapted for long distance transportation, and is capable of operating in variety of weather conditions. New system is called "Pneuma," functions inside cylindrically closed reservoirs, and is a true piston pump. Elements that comprise it are independent of each other and are connected solely by means of flexible rubber hose.

A0147 "Volvox Hollandia, Large Side Trailing Suction Dredger," Shipping World and Shipbuilder, Vol 164, No. 3856, Apr 1971, pp 457-458.

10,000 dwt side trailing, twin suction single hopper dredger has a length of 112.05 m, a beam of 19.00 m, a draft of 8.77 m, and is powered by two turbocharged 8-cyl diesel engines, each developing 3550 bhp at 525 rpm with service speed of 13.5 knots. Dredging is carried out through two 900 mm diam trailing suction pipes, one on each side of vessel, which are capable of operating at depth of 22.5 m, although provision has been made to increase dredging depth to 32 m.

W

A0148 "World's First Platform Dredger--Al Wassl Bay," Dock and Harbour Authority, Vol 60, No. 705, Aug 1979, pp 125-126.

Dredging work required for construction of the new port Mina Jebel Ali, Dubia, has resulted in construction of world's first self-elevating, heavy duty offshore cutter suction dredger, Al Wassl Bay, built by Mitsubishi Heavy Industries, Japan. The dredger can jack itself out of water during adverse weather conditions and has moveable legs so that continuous dredging is possible. Article presents details of vessel's dimensions and dredging equipment.

INSTALLMENT 2

Reference Numbers 0499 - 0876

A0149 - A0289

0499 ABBOTT, P. 1980 (Mar). "The Dredging Revolution," Civil Engineering (London), pp 72-73.

The launching of a semi-submersible cutter suction dredger is discussed. The 'Simon Stevin' can dredge in wave heights up to 2.5 m, and in hard soil conditions. Dredge can move 50,000 m^3 per week and can work in wave and soil conditions in which it is uneconomic to use present equipment.

0500 ABDEL-SALEM, M. 1968. "The Major Development Project of the Suez Canal," Proceedings, World Dredging Conference, WODCON II, pp 914-932.

History of the Suez Canal, present day depth and width demands, plans for improvements, maintaining traffic during dredging operations, equipment used, and dredging plans for specific sections of the waterway are discussed.

0501 ADAMS, J. R. and GUPTA, R. P. 1970 (Aug). "Gas Removal System. Part III: Model Study. Final Report," Report No. 310.22, Lehigh University, Fritz Engineering Laboratory, Bethlehem, Pa.

A modified accumulator was used in gas removal systems with either a reciprocating vacuum pump or a water ejector as the vacuum source. Accumulator has an opening approximately 2.67 suction pipe diameters long with a sloping top on the upstream side.

Accumulator proved to be an effective gas trap. Once gas entered the accumulator it could be removed through the top.

Accumulator liquid level was found to be very important. Higher liquid levels result in more gas being removed. Dredge pump speed was not found to be a significant variable.

0502 ADAMS, J. R. and HERBICH, J. B. 1970. "Performance of an Improved Accumulator for Gas Removal," Proceedings, World Dredging Conference, WODCON III, pp 219-245.

Gas removal systems are an important auxiliary for hydraulic dredges operating in harbors and estuaries. Gas encountered in dredging undergoes considerable increase in volume before reaching the dredge pump. A moderate amount of gas (10 to 20 percent of the water discharge at pump suction conditions) causes the pump to "collapse" or lose its prime.

A modified accumulator was built and tested. A 45 degree slope on the upstream side of the accumulator doubled the length through which gas could enter the accumulator. Significant quantities of gas are removed under steady or unsteady gas flow.

Quantitative results are presented to demonstrate improvement in gas removal and thus dredging efficiency.

0503 AHLF, J., ANDERS, D., and ROSOMM, H. 1976 (Jun). "Hydraulic Sample Conveying System for the Exploration of Marine Sands and Placers," Proceedings, Interocean '76, DM, pp 36-41.

A hydraulic sample conveying system is described, which - together with a suitable analyzing system may be used for the exploration of marine sands and alluvial ores. The system consists mainly of a sampling device, vibracorer, flush water pump, conveying hose line and separator. Compared to an airlift method the water flush system has two essential advantages: (i) available hauling pressure is independent of operational depth; (ii) there is only a two phase flow in the conveying line. Design considerations were based on conditions as they were found on the occasion of titanium ore exploration offshore from Mozambique. The main demands besides a low susceptibility to trouble are short sampling time and sufficient accuracy in correlating the conveying material to the penetration depth of the sampling device. Values were taken as a design basis and calculations are given. A test conveying line allows components tests and trials to verify calculations.

0504 ALI, K. H. M. and HALLIWELL, A. R. 1980 (Mar). "The Use of Water-Jets for Scouring and Dredging," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 239-265.

Paper describes an extensive experimental investigation of water jet performance as a scouring mechanism.

Systematic experiments were conducted to study the influence on floor velocities of the following parameters:

(1) Water jet elevation above bed
(2) Operating head
(3) Downstream water-level
(4) Size, shape and direction of jet nozzles and
(5) Form of bed - whether rigid or composed of movable particles.

Study was applied to a sluicing problem at the tidal Bromborough Dock (U.K.). Model experiments showed that the use of a pre-fabricated nozzle at the end of the sluicing-duct should result in high floor velocities near lock entrance, thus providing an automatic scouring mechanism.

0505 ANDERSON, A. W. 1978 (Sep). "Major Marine Legislative Actions in the 95th Congress," Proceedings, Oceans '78, MTS/IEEE, p 242.

Significant marine legislative actions in the 95th Congress are summarized. More than 20 of the 278 Public Laws enacted dealt with marine and/or ocean matters. Important legislation includes: The Rivers and Harbors Improvements Act of 1978; and The Nat'l Ocean Pollution R&D and Monitoring Act of 1978.

0506 ARGALL, G. O. 1976 (Mar). "Bucket Wheels, Dredges, Draglines Strip and Mine at Billiton Suriname," World Mining, Vol 29, No. 3, pp 46-51.

Dredging, as the first phase of a three system stripping program, removed 14,864,766 cubic yards of overburden to an average depth of 16.4 feet. Overburden was pumped to disposal areas 11,808 feet away. Overburden was slime, mud, clay, silt, and sand which included many buried logs, tree stumps, roots and other vegatable trash.

0507 ARKEMA, W. J. and ELSHOUT, J. VAN DEN. 1980 (Mar). "Wheel Excavators," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 333-343.

Wheel excavators combine the properly controllable, smooth excavating process of the bucket dredge with the subsequent hydraulic transport of the dislodged spoil of the cutter dredge. The biggest problem is in the transition from the cutting process to the suction process. Serious blockage may occur in sticky soils which adhere to metal surfaces. Paper describes a dredging wheel shape which is not subject to blockage.

0508 ARNBORG, L. 1965. "Suspended Load Transportation and Deposition in Connection with Dredging of River Beds," Proceedings, Eleventh International Hydraulics Congress, IAHR, pp 1-9.

Paper discusses estimation of turbidity effects by dredging in river channels. Dredging may bring sediment particles in suspension, and are deposited downstream in a distribution dependent on the original sediment and the fluvial conditions. For the sedimentation pattern prediction, a special formula by Sundburg (1964) can be used. Formula includes water discharge rate, water temperature, turbulence, channel depth and particle size distribution. An application on water quality changes due to construction of a water power plant in a Swedish river is described.

0509 ARTUS, C. 1978 (Aug). "Handle Sand Suction Hoses and Dredge Sleeves with Care," World Dredging and Marine Construction, Vol 14, No. 8, pp 9-13.

Sand suction hoses and dredge sleeves are used as flexible connectors for suction and discharge lines on dredging barges in 3 general locations: gravel pits or lakes where sand and gravel are pumped ashore; coastal areas where sand, gravel or shells are pumped to shore or onto barges; and river locations, using barge or shore discharge. Sand suction hose size is determined by the pipe size of suction or discharge line on the dredge. Table is given to match proper hose and pipe size.

Paper describes use, sizing, and maintenance of sand suction hoses and dredge sleeves.

0510 ARTZ, J. C. 1975 (Sep). "The Economics of Dredging Sand and Gravel for Aggregate," Proceedings, First International Symposium on Dredging Technology, BHRA, Paper A2.

Sand and gravel is dredged from the sea bed at certain offshore sites of the U. K. This material is primarily intended as aggregate for concrete. Dredges used in the industry range in hopper size from 300 tons to 2300 tons with even larger sizes in prospect. This report is concerned with some of the economic aspects of this relatively new and growing industry as revealed by a study of one particular firm and its vessels. The data have been analyzed by treating each dredge as though it were a separate firm, the objective being to arrive at an internal rate of return (IRR) for each dredge. Implications of differences in IRR as related to vessel size are noted and used to develop a model for a tug/barge/dredger operation in one coastal area. Results indicate that the rug/barge/dredger combination has a higher rate of return than the traditional system.

0511 ATJAK, M. G. 1975 (Aug). "Concentrating Ore at Sea," De Ingenieur, Vol 87, No. 34, pp 661-665.

Article is restricted to alluvial deposits and aggregate minerals such as sand, gravel, shell and coral. Bucket dredging is discussed with particular reference to cassiterite mining. Equipment for concentration and its operation are described at length. Author considers that the modification of the hydraulic drive which enables pulsators to act consecutively instead of simultaneously is a great improvement. Use of improved cyclones for ore concentration is also discussed.

0512 AYUKAWA, K. and OCHI, J. 1968 (Jun). "The Hydraulic Transport of Solid Materials Through a Horizontal Straight Pipe," Japanese Society of Mechanical Engineers.

The formula for pressure drop in a flow with a sliding bed of large particles through a horizontal straight pipe is derived from equating the expense of solid particle energy caused by friction of them sliding on a pipe wall to the work done by an additional pressure drop due to conveying solid particles. Modification factor in this formula is estimated basing on the results of experiments in conveying coal and gravel as the function of parameters which are obtained from the similarity conditions for particle motions. Formula is in good agreement with experimental results within the errors of measurement.

It is shown that the relation between mean velocity of a flow and pressure drop in a flow with a sliding bed is greatly different from that of a hold up flow. Critical velocity from the former flow to the latter is obtained as the function of pipe diameter and specific gravity of particles.

0513 BABCOCK, H. A. 1967. "Head Losses in Pipeline Transportation of Solids," Proceedings, World Dredging Conference, WODCON I, pp 261-304.

Engineering parameters of pipeline transportation are considered. Discussion of pipe size, optimum concentration, transportation velocity headloss, abrasion rates, degradation rates, and effect of power failure are given.

0514 BABYLON, A. 1980 (Mar). "A New Entry Channel to the Port of Le Verdon," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 191-207.

This pass, originally dredged to a depth of 9.50 m, has progressively been deepened to provide a guaranteed depth of 13.50 m. Having made a study of scale models, the Port of Bordeaux opted for a new course for the channel and the creation of a new outer pass, offering better guarantees of stability. The works were carried out under government supervision, with the State owned dredgers, 'P. Durepaire' and 'P. H. Watier' (both with hopper capacities of 1,340 m^3) and the 'F. Leveque' of 4,000 m^3, began in June 1978. The pass will then have a width of 400 m and a depth of 13.50 m.

0515 BAILARD, J. A. and INMAN, D. L. 1975 (Sep). "Analytical Model of Duct-Flow Fluidization," Proceedings, Modeling Techniques Symposium, ASCE, pp 1402-1421.

An analytical model of duct-flow fluidization technique for transporting sand is developed, using unidirectional flow theory. Dimensionless pressures and velocities are obtained from numerical solution of six difference equations and three boundary conditions. Preliminary laboratory tests were made of a 6.1 m long fluidizing pipe oriented both horizontally and with a 3 degree downward slope. Good agreement between experiment and theory suggests that model provides basis for further development of this method of sand transport. Model shows that for similar flow conditions, the length of unvented duct-flow increases with increasing thickness of overburden.

0516 BARBER, L. F. 1972 (Mar). "The Continuous Dragline Dredge-A Concept," World Dredging and Marine Construction, Vol 8, No. 4, pp 21-22.

New system of dredging has been designed to replace conventional bucket-elevator and hydraulic types. Dredge employs a number of dragline buckets connected by cables on each side, which gives a digging action similar to the dragline but with the added advantages of a conventional bucket line which swings across the digging surface. Dredge digs on a catenary, which provides a cushion for the buckets against wave action. A suspended lower idler device is used to shorten the hull

length which would be necessary for a pure catenary. Although limits are not known, it is expected to be able to dredge to a 300 ft depth using 3-cubic yard buckets.

0517 BARBIER, J. M. 1980 (Mar). "Maintenance Policy for the Access Channel to the Port of Bordeaux-Bassens," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 163-176.

Paper describes how depths have been improved for the Port of Bordeaux-Bassens without an increase in dredging capacity. These improvements are the result of (1) capital investment operations; (2) improved performance of equipment; (3) better control of bed evolution, both inside and outside the channel; and (4) a new policy for dredger utilization in maintaining channels. Emphasis is on the latter two, where forecasts of future beds and states of consolidation have allowed for greater dredge effectiveness.

0518 BASCO, D. R. ET AL. 1972 (Nov). "Proceedings, Fifth Dredging Seminar," Report CDS-194, Texas A&M University Center for Dredging Studies, College Station, Texas.

Proceedings contains 7 papers discussing: design and construction of dredges; offshore dredging problems; soil mechanics applied to dredging; and dredged spoil disposal.

0519 BASTIAN, D. F. 1974 (Nov). "Effects of Open-Water Disposal of Dredged Material on Bottom Topography Along Texas Gulf Coast," Miscellaneous Paper D-74-13, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Analysis of hydrographic surveys of hopper dredge disposal areas in the Gulf of Mexico off the Texas coast indicated that dumping at these sites had little effect on bottom topography. Apparently there are no definitive, discrete mounds of dredged material formed as a result of open-water disposal.

0520 __________. 1978. "Early Dredging Problems at Mouth of Mississippi Spanned 150 Years," World Dredging and Marine Construction, Vol 14, No. 8, pp 22-23.

Article presents a historical account of the technological problems encountered in dredging the mouth of the Mississippi river during the years between 1717 and 1877. During this period, the mouths of the Mississippi had experienced a number of different types of dredging from the earliest raking by the French through the ladder bucket, and finally to hydraulic dredging in 1877.

0521 __________. 1980 (Oct). "The Salinity Effects of Deepening the Dredged Channels in the Chesapeake Bay," Proceedings, World Dredging Conference, WODCON IX, pp 497-508.

Recent tests on the Chesapeake Bay Model, the world's largest estuarine model, were used to assess the effects of increasing the

approach channels to Baltimore from 13 meters to 15 meters. The increased depth of channel would extend the length of dredged channels to 79 kilometers.

To give meaningful results, a 2-1/2 year hydrographic period was simulated in the model to enhance evaluation by adding variable discharge as a parameter. Furthermore, a 12 constituent harmonic tide was used giving a 28-lunar-day tidal sequence which simulating a lunar month was repeated throughout the test. The entire test was repeated but with the 15 meter channel installed.

The primary result from the test is comparison by location of the changes from base to plan of salinity time histories which vividly show effects of geometry, tidal and discharge changes.

0522 BATCHELDER, G. W. 1975 (May). "The 'Stump', a New Dimension in Dredging," Proceedings, Seventh Annual Offshore Technology Conference, Vol 2, Paper OTC 2289, pp 419-432.

New type dredge is described which is expected to do the work of a conventional hydraulic dredge in sheltered waters and to meet the urgent new requirements for working in depths of up to one hundred feet. Dredge is designed to overcome physical limitations of many present and future projects efficiently and economically.

0523 BATES, A. D. 1978 (Mar). "Portable Cutter Suction Dredgers.... Some of the Problems," Dredging & Port Construction, Vol 5, No. 5, pp 12-17.

Author considers the following aspects of portable cutter suction dredgers: choice of dredger; estimation of production; ancillary equipment such as onshore pipelines, floating pipelines, workboats, equipment for on-land pipe handling, anchors and cutterheads; and temporary site structures.

0524 __________. 1978 (Dec). "Recent Development in Dredging Technology," Dock and Harbour Authority, Vol 59, No. 697, pp 237-245.

Significant improvements in dredge and ancillary equipment designs within the last 10 years are reviewed. Cutter suction and trailing suction dredges are emphasized while bucket, grab, dipper, and backhoe dredge design changes are only briefly described. Also covered are pump, cutterhead, drag head, electronic equipment, and portable dredge improvements and current industry trends in all areas of dredging equipment.

0525 BEARD, R. M. 1976 (Apr). "Expendable Doppler Penetrometer: Interim Report," Report No. AD A026 107, Technical Note N-1435, Naval Construction Battalion Center, Port Hueneme, Calif.

An expendable penetrometer using the Doppler principle has been developed to expediently test seafloor soils at water depths up to 20,000 feet. The velocity of the penetrometer is measured as it penetrates seafloor soils; from the velocity record, soil penetrability and

an estimate of soil strength are available. Initial testing indicates that the concept of a Doppler instrumentation system is workable, that penetration can be accurately determined, and that deceleration can be ascertained.

0526 BEARD, R. M. 1977 (Jul). "Expendable Doppler Penetrometer, a Performance Evaluation," Report No. CEL-TR-855, Naval Facilities Engineering Command, Alexandria, Va.

An expendable penetrometer using the Doppler principle has been developed to expediently test seafloor soils to a depth of 9 m (30 ft) at water depths to 6,000 m (20,000 ft). The velocity of the penetrometer is measured as it penetrates seafloor soils. From the velocity record, soil penetrability and an estimate of the undrained shear strength profile can be calculated. Report presents data from 11 tests at four locations off the southern California coast. Undrained shear strength profiles determined from penetrometer data are compared to other types of in-situ data and core data. It is concluded that the expendable Doppler penetrometer is reliable and simple to use and that reasonable estimates (30 percent of actual values) of undrained shear strength profiles can be obtained even though the analyzed phenomenon is complex.

0527 BECKMANN, H. 1976 (Jun). "Logging the Sea Floor with Geoelectrical Systems," Proceedings, Interocean '76, DM, Paper 1076-405, pp 1069-1080.

Geoelectrical systems offer a wide variety of technical possibilities for mapping sediments on the sea floor and for exploring marine ore deposits. Logging methods with induced potentials have been developed using the principles of Wenner, Schlumberger, Williams. Other systems use focussed arrays similar to the microlaterolog. They enable the sea floor resistivity and bottom water to be logged for calculation of the ohmic formation factor. Some of these systems enable direct measuring of the formation factor. From the ohmic formation factor the type of sediment, its porosity and solidity can be derived.

0528 BEEMAN, O. and HARTMAN, G. 1980 (Oct). "Dredge Planning for Lake Reclamation, a Case Study," Proceedings, World Dredging Conference, WODCON IX, pp 287-300.

Inactive methods used in the Vancouver Lake Reclamation dredge planning effort are discussed. Project called for removal of over 8 million cubic meters of material, multiple sediment types, contained dike disposal areas and pumping distances of over 3000 meters. A lake perching concept to control dredging depths and application of linear programming techniques to optimize the dredging versus disposal site costs are two examples cited that were used in the planning phase.

0529 BENNETT, D. W. 1967. "Capabilities and Applications of the Becker Drill for Offshore Sampling and Mining Explorations," Proceedings, World Dredging Conference, WODCON I, pp 461-469.

Paper describes capabilities and some applications where the Becker Drill has proven successful on offshore or subsea sampling.

0530 BHATTACHARYA, S. K. and BISWAS, A. N. 1973 (Feb). "Evaluation of Harbor Deepening Projects," Journal, Waterways, Harbors, and Coastal Engineering Division, ASCE, Vol 99, No. WW1, pp 111-123.

World shipping trends show that large vessels are being progressively commissioned for the transport of commodities such as petroleum, ores, and fertilizers due to the low transportation cost in such carriers. Consequently, the approach channels to the ports are being deepened to accomodate such vessels. Construction of a subsidiary deep-dock system at Haldia, India, has been taken up to provide access to carriers with 40 ft draft, principally for the cargoes of crude petroleum and ore. Consequently the navigation channel from the sea to the dock system has to be deepened necessitating a large investment. For the evaluation of such a channel deepening project general equations to determine costs and benefits are developed. Methodology is applied to the evaluation of benefits in the case of the channel to Haldia.

0531 BINNIE, A. M. and PHILLIPS, O. M. 1958 (May). "The Mean Velocity of Slightly Buoyant and Heavy Particles in Turbulent Flow in a Pipe," Journal of Fluid Mechanics, Vol 4, Part 1, pp 87-96.

A large number of small spheres were injected successively into a horizontal pipe conveying water at constant mean velocity, and their times of transit were measured. Theory is developed to show how the sphere mean velocity depends upon their relative density and size.

0532 BLANKEVOORT, D. 1976 (Sep). "Improvements in or Relating to Dredging," British Patent No. 1449863, Oct 1973.

Device considered is designed to raise soil to the surface of a water body with only its natural water content so that the coherence of the soil is not disrupted and no dewatering is necessary. Apparatus consists of lift tube into which compressed air is injected in pulses at a pressure sufficient to overcome the pressure prevailing in the tube at that level. Air causes the soil to form into plugs and the resulting plugs and air cushions are driven to the surface. Air cushions expand as they rise causing plugs to accelerate, thus overcoming friction without changing plug coherence. Cutting tool for use in stiffer soils is also described.

0533 BLANKINSHIP, B. T. 1975. "Problems and Challenges in the Dredging Program of the U. S. Army Corps of Engineers," Proceedings, World Dredging Conference, WODCON VI, pp 17-35.

Dilemma facing dredging interests in the U. S. is presented and causes of this problem are explained. Some of the Corps of Engineers efforts in meeting this challenge are described.

0534 BOEHME, H. F., SRIVASTAV, A. N. L., and LOCHRIDGE, J. C. 1979 (Dec). "Pipe-Burying, Underwater Trenching Apparatus and Method," British Patent No. 2022168A, Mar 1979.

Patent describes an underwater trenching apparatus and method. Device designed for burying a pipeline that is already lying on the sea floor.

0535 BOERGER, F. C. and CHENEY, M. H. 1976 (Jan). "Economic Impact of Dredging Regulations," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 408-417.

Tangible and intangible costs caused by or associated with dredging regulations are high, compared to actual cost of dredging operations. In the case of small projects, regulatory costs may easily exceed dredging costs. The reasons these costs are so high appear rooted in the problems which characterize the regulation of dredging: too many agencies involved, lack of agency coordination, lack of properly defined procedures, lack of time limits within which agencies must act, questionable criteria and the uncertainty inherent in the regulatory process. The tangible and intangible costs identified and evaluated in paper give an indication of the economic impact of current dredging regulations.

0536 BOKHOVEN, W. 1968. "Dredging in the Port of Rotterdam After World War II," Proceedings, World Dredging Conference, WODCON II, pp 933-971.

The Port of Rotterdam is passing through a dynamic period of development, mainly as the result of the industrialization of the Netherlands since the end of the war, and the post war boom which prevailed in many countries of Western Europe, which rely on the Port of Rotterdam for their outlet to the world.

Only at the end of 1949 was all war damage to the harbor repaired and a beginning could then be made to expand and to construct new harbor works. Since then, harbor expansions have taken place at an ever increasing rate. Article describes these expansions.

0537 BOOMSTRA, G. J. W. 1975 (Sep). "A Cutter Dredge," British Patent No. 1405581, Sep 1975.

Cutter dredge cutter usually comprises a ring of knives which cut chips or shavings of ground in a beating motion. Problem with the discontinuous knife action is that vibrations are generated causing undue wear of components, and the beating action blunts the knives very quickly. A further problem is that cut-off chips, once they are dropped back on the bottom of the cutter, have difficulty in getting through the opening between the rotating knives in the suction tube which has its intake end immediately above the cutter. Also, ground removal is not optimised with a great proportion of water being sucked in through the large openings between knives. Present invention is designed to overcome these difficulties. Cutter dredge comprises in combination a

ladder, a suction tube supported by the ladder and having a pivotable end portion, and a dished disk cutter mounted for rotation at the free end of the end portion of the suction tube with the concave side of the disk cutter facing said free end. Vibrations are no longer generated, and power required for the cutting operation is substantially less.

0538 BOUMA, A. H. ET AL. 1975 (May). "Electrical Logging Systems and Results of Unconsolidated Marine Sediment," Proceedings, Seventh Annual Offshore Technology Conference, Vol 2, Paper OTC 2222, pp 753-759.

Application of electrical logging technology to the study of unconsolidated marine sediments is still in its early stages. Progress in instrumentation development and results from sea trials indicate the potential for marine logging techniques. Existing electrical logging analytical techniques cannot be extrapolated readily to produce reliable parametric values in unconsolidated marine sediments. Electrical resistance and spontaneous potential measurements made on extruded cores appear to be relatable directly to various geological and geotechnical parameters. These core scanner data also have been checked by absolute resistivity measurements made on small cylindrical samples taken from the same cores. Horizontal correlation of sediment strata over long distances can be conducted rapidly with an in situ electrical logging probe.

0539 BOWEN, S. P. 1976 (Jan). "Modeling of Coastal Dredged Material Disposal," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 202-225.

A major concern in open water disposal of dredged material is the ultimate fate of the dredged material solids. Estimates of location and concentration of both settled solids and those remaining in the water column will allow evaluation of the environmental impact of the discharge, selection of optimum locations of discharge points and methods to optimise placement, evaluation of relative merits of alternative disposal sites, and other critical problems related to dredged material disposal. Several mathematical models have been developed to describe dredged material disposal. Paper discusses these models and their application to a number of dredged material disposal problems. A physical modeling procedure is presented for analysis of instantaneous dumpings in shallow water.

0540 BREEJEN, H. T. DEN, ed. 1970. Proceedings, Dredging Today, Centrale Baggerhedrijf, The Hague, The Netherlands, pp 10-61.

Contributions include: (1) Development of the dredging industry, (2) Planning of modern harbors, (3) Adapting harbor approaches to the requirements of increased shipping traffic, and (4) Progress in dredging.

0541 BREUSERS, H. N. C., ALLERSMA, E., and VAN DER WEIDE, J. 1968. "Hydraulic Model Investigation in Dredging Practice," Proceedings, World Dredging Conference, WODCON II, pp 92-116.

Use of hydraulic models to solve dredging related hydraulic and rheologic problems is discussed. Major categories include equipment behavior during the dredging process, the dredging process itself, and effects of dredging on the environment. Applicability of modeling techniques, model deficiencies, and expected information obtained from hydraulic models are all reviewed with numerous examples cited for each of the major categories.

0542 BROOKS, J. 1979 (May). "Trench-Jetting Apparatus," British Patent No. 2006302A, Sep 1978.

Trenching tools are disclosed for underwater trenching operations. Tools have elongate tubular members which are provided with nozzles from which water jets are directed at the bed material in which the trench is being cut. Jets displace bed material for cutting and/or keeping open the trench.

0543 BROSSARD, C. 1980 (Mar). "Organisation and Surveillance of a Maritime Dredging Contract," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 1-12.

Organization of a dredging contract requires the exchange of all available site information between the works owner and contractor. Exact design objectives and details should be clear to both parties. Under these conditions, article states that execution and surveillance can proceed smoothly. In French.

0544 BRUCE, A. C. 1974. "Power Electronics as Applied to Dredges," Proceedings, World Dredging Conference, WODCON V, pp 411-436.

Paper provides details on a silicon controlled rectifier, "Thyristor" for use on dredges. Special emphasis is placed on bucket ladder dredges using same as an electrical variable speed drive.

0545 BRUUN, P. 1973. Port Engineering, Gulf Publishing Co., Houston, Tex.

Modern trends in port engineering; port navigation and hydraulics; planning and layout of ports; littoral drift and sedimentation problems; coastal geomorphology vs. port engineering; tidal inlets on alluvial shores, dredging technology; and small craft harbors are all covered.

0546 __________. 1980 (Jul). "Siltation in Estuaries," Terra & Aqua, No. 19, pp 7-15.

Siltation problems in estuaries and their causes are reviewed. Attempts to overcome them have included structural and hydraulic means (such as training walls), and suction dredging. Owing to environmental effects, controlled agitation dredging methods are now being considered. The air-lift method offers the most reliable means of turbidity control, followed by propeller and jet-lift methods. Tests seem to indicate that agitation dredging is competitive with other types, particularly as there is no dispoal problem.

0547 BUCKLEY, C. P., COXE, F. S., and SHEV, O. 1970 (Dec). "The Seafloor Excavator; Volume I, Summary," Report No. NORT-70Y137-Vol 1, Northrop Corp., Anaheim, Calif.

Four-volume report describes system definition and analysis process through which a deep-ocean Seafloor Excavator is developed. Eight concepts are initially formulated and studied, with the three most practical being further developed. Comprehensive system and cost analysis of the three selected concepts is performed to determine the single, most effective concept. Preliminary design and design specifications for this concept are developed. Resulting design is of a wide-tracked, remotely operated submersible vehicle equipped with a revolving, extendable (jackknife) dredging arm capable of performing earthmoving, excavating dredging tasks in waters as deep as 6000 feet.

0548 __________. 1970 "The Seafloor Excavator; Volume II, Part I: Preliminary Design; Part II: Specifications," Report No. NORT-70Y137-Vol-2, Northrop Corp., Anaheim, Calif.

System definition and analysis process through which a deep-ocean Seafloor Excavator is developed is described. Eight concepts are initially formulated and studied, with the three most practical being further developed. A comprehensive system and cost analysis of the three selected concepts is performed to determine the single, most effective concept. Preliminary design and the design specifications for this concept are developed. Resulting design is of a wide-tracked, remotely operated submersible vehicle equipped with a revolving, extendable (jackknife) dredging arm capable of performing earthmoving, excavating dredging tasks in waters as deep as 6000 feet. Report is comprised of four volumes. This volume contains preliminary design and specifications.

0549 __________. 1970. "The Seafloor Excavator; Volume IV, Appendices," Report No. NORT-70Y137-Vol-4, Northrop Corp., Anaheim, Calif.

System definition and analysis process through which a deep-ocean Seafloor Excavator is developed is described. Design is of a wide-tracked, remotely operated submersible vehicle equipped with a revolving, extendable (jackknife) dredging arm capable of performing earthmoving, excavating dredging tasks in waters as deep as 6000 feet. Report is comprised of four volumes. This volume contains supporting and supplemental data developed during the course of this program.

0550 BURTON, R. 1980 (Jul). "Dredger Positioning Comes of Age," Dock and Harbour Authority, Vol 61, No. 716, pp 74-75.

In an attempt to reduce the margin for error in positioning and to save on cost, a range of automated systems has been introduced. Artemis, Syledis, Motorola Mini Ranger and the MRD1 (Tellurometer) are among the position fixing systems available. Diagram indicators which indicate draghead position relative to the dredger and profile computers are in use to ensure greater operational efficiency.

AD-A137 453 DREDGING: AN ANNOTATED BIBLIOGRAPHY ON OPERATIONS EQUIPMENT AND PROCESSES REVISION(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS HYDRAULICS LAB MAR 82 WES/HL-82-7

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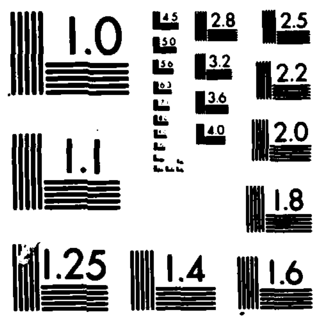

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0551 BYLES, R. 1976 (Sep). "Synchronous Sight Aides 'Blind' Drivers," New Civil Engineer, No. 210, p 27.

Bucket dredging operations normally depend on operator's skill to place the bucket in position underwater. Article describes a simulator screen mounted in the cab, with a 1:50 scale flat steel model of the bucket, synchronized to move with excavator's arm and bucket, enabling driver to 'see' bucket position. Device will justify its cost by improving precision, and reducing operating time and manpower requirements.

0552 __________. 1979 (Oct). "Newlyn Quay Gambles on 'No Spares' Dredger," New Civil Engineer, No. 364, pp 18-19.

The use of a secondhand 60t Koehring 1066 pontoon mounted hydraulic excavator to boost dredging in the deep water area of the new jetty and quay at Newlyn, Cornwall, should enable project to be completed on schedule despite unexpected early delays in dredging the sea bed.

0553 CABLE, C. C. 1969. "Latest Developments in the Design and Operation of Dredging Equipment, in Particular as Regards Suction Dredging in Very Deep Water," Proceedings, Twenty-second International Navigation Congress, PIANC, Sec. II, Subj. 2, pp 115-132.

Paper describes use of sea going hopper dredgers to nourish ocean beachfront; use of sidecast dredges to construct and maintain ocean inlet channels; development of a shallow draft dredge to work in coastal inlets; capability of the new dredge McFarland; capabilities of several new pipeline dredges for ocean work; and discusses some future trends and what they may mean in the line of dredging equipment.

0554 CABLE, C. C. and MURDEN, W. R. 1974. "Dredging and Disposal Practices on the Great Lakes," Proceedings, World Dredging Conference, WODCON V, pp 225-249.

Paper reviews the present status of dredging and disposal activity by the Corps of Engineers, in constructing and maintaining navigation channels and harbors in the Great Lakes area. The changes made in both dredging equipment and disposal methods to provide the desired environmental quality envisioned by Congressional law authorizing contained spoil disposal facilities is discussed.

0555 CALDWELL, D. H. and BABBITT, H. E. 1941 (Feb). "Flow of Muds, Sludges and Suspensions in Circular Pipe," Industrial and Engineering Chemistry, Vol 33, No. 2, pp 249-256.

Theoretical analysis of the flow of sludges in circular pipe is presented. Two distinct types of flow occur depending upon the velocity of flow. These two types of flow have been termed "plastic flow" and "turbulent flow." The velocity at which plastic flow changes to turbulent flow is called critical velocity.

Equations are developed and verified experimentally for determining friction losses for plastic flow and for turbulent flow in circular pipe. An equation for the determination of the critical velocity is also presented together with experimental verification.

Methods of determining the significant constants in the plastic flow and critical velocity equations are described.

0556 CAMPBELL, S. 1976 (May). "Savings Expected from Polyethylene Pipe Use," World Dredging and Marine Construction, Vol 12, No. 6, pp 39-40.

Production of polyethylene pipe for use in the dredging industry, its advantages, wear resistance, lightness, flexibility and disadvantages are discussed.

0557 CARR, J. S. 1973. "Dredging for Gold in New Zealand," Proceedings, World Dredging Conference, WODCON V, pp 651-684.

Certain features of gold dredging operations are examined, in particular the relationships between dredge equipment and the practice of dredging and various technologies. Subject matter is developed from the viewpoint of the objectives of a dredging system and its sub-systems, which must perform inter-related functions with specified capabilities.

0558 CARTER, M. 1974 (Sep). "Water Witch Dredge Clears Weeds, Debris," World Dredging and Marine Construction, Vol 10, No. 10, p 8.

Design features and operation of a self-propelled mini dredge, called the Water Witch, are described. The one-man operated craft can work in as little as 3 feet of water, collecting debris in docks and harbors. Dredge can be lifted easily in and out of the water to be transported from one site to another.

0559 CARVALHO, E. E. M. M., ed. 1975. Dredging Bibliography; Vol 2, 1971-1974, Latin-American Dredging Association, Rio de Janeiro.

Volume contains 1242 references; indexes by author, title and subject are included.

0560 CHEVALIER, J. 1962. "Review, Description, and Critical Examination of Cavitation Test Methods on Scale Models," Proceedings, Working Group No. 1, Societe Hydrotechnique de France, La Houille Blanche, No. 4, pp 537-551.

Survey results are given for a study on laboratory model cavitation research facilities and methods. Article describes experimental means and installations, discusses scale and cavitation similitude, and compares results and conclusions.

0561 CHI, P. C. 1974. "A Case Study of Reshoaling Problem of an Artificial Harbour on Sandy Beach," Proceedings, World Dredging Conference, WODCON VI, pp 37-59.

Article describes construction and maintenance of the Tai-Chung Harbor in Taiwan by hydraulic dredges. Project involved dredging of over 22.4 million cubic meters for the initial construction. The harbor was originally built on a wide sandy beach and has experienced severe shoaling problems. As much as 50% of the original material dredged has reshoaled within a year after construction. Major causes cited are a strong littoral drift and large amounts of deflation material from nearby beaches. Recent studies and possible solutions to the shoaling problem are described.

0562 __________. 1980. "Launching Caisson by Dredging," Proceedings, World Dredging Conference, WODCON IX, pp 841-872.

Study was based on site construction experience of the first stage works of Tai-Chung Harbor Project during 1973-1976. The method by which the caisson was constructed along the seashore and launched by dredging is discussed. In case of Tai-Chung Harbor Project, 109 caissons were completed on the beach and launched by dredging to meet the schedule.

0563 CHISHOLM, J. J. 1978. "Maintaining New York Harbor for Waterborne Commerce," Proceedings, Second International Waterborne Transportation Conference, ASCE, pp 580-583.

The New York District of the Corps of Engineers has been involved in the construction and maintenance of forty federal navigation projects on the area since 1834. The Port of New York contains some 262 miles of federal shipping channel ranging in width from 50 ft to two-thirds of a mile and in depth from 3 to 48 ft. Maintenance dredging in the harbor involves the removal of 8 to 10 million yd^3 of material annually. A dredging plan drawn up annually by the Corps is based on requirements, dredger availability, and funds on-hand, and establishes a priority system to maintain channels at their authorized depths and widths. Approximately twenty million dollars a year in federal funds are expended on dredging.

0564 CLARK, B. L. 1974 (Aug). "Power of the Dredger," Consulting Engineer, Vol 38, No. 8, pp 56-57, 59.

Developments and progress in design of modern dredges in Netherlands are outlined. Author emphasizes that modern dredges can move a million cubic meters of sand in a week.

0565 CLARKE, H. C. 1975 (Jun). "Alluvial Mining Using Bucket Dredges," De Ingenieur, Vol 87, No. 34, pp 645-648.

Article is limited to aspects of mining alluvial tin deposits offshore, and also restricted to tin mining operations in South East Asia. Data presented are based on bucket dredging in the sea off the west coast of Thailand. Delt with are: Recovery plant on board; Operation cost breakdown; Onshore and offshore; and Keeping records of shutdown time.

0566 CLAUSS, G. 1971. "Airlift Systems for Mineral Recovery in Ocean Mining," Proceedings, World Dredging Conference, WODCON IV, pp 171-206.

Three deep mining systems of current interest are discussed: hydraulic dredge, airlift and continuous bucket-line system. Especially for the airlift, detailed calculations have been carried out investigating the influence of variables like solid discharge, air-water ratio, relative depth of air injection, specific weight and size of the solid particles. Results show the feasibility of the airlift for mineral recovery from the sea floor due to its simplicity and efficiency. Flow characteristics of an economic airlift system conveying manganese

nodules from the deep ocean floor are calculated and a combined mining system with an underwater container in 50 m depth at atmospheric pressure is proposed.

0567 CLEAVELAND, N. 1967. "Some Comments on Dredging as a Mining Method," Proceedings, World Dredging Conference, WODCON I, pp 1-19.

Paper discusses history and advancement of the dredging bucket line, bucket ladder and elevator dragline and suction cutter dredges.

0568 ________. 1977 (Dec). "The Economics of High Profile Mining Dredges," World Dredging and Marine Construction, Vol 13, No. 13, pp 24-26.

Author discusses the possibility of improved efficiency in power consumption through changes in design and operation of mining dredges. The effect of slime-slurry-sludge-muck (SSSM) on economics of mining dredges is considered. The question of increasing top tumbler height is also discussed.

0569 ________. 1978. "More Time at Lower Costs," World Dredging and Marine Construction, Vol 14, No. 8, pp 36-37.

Author describes current bucket ladder dredging methods in ponds and states that the presence of thick mud and debris layers may cause production losses of 10% or more. This is especially true for tin production. Elimination of fine suspended ore in these ponds can make significant production increases and lower production costs. The use of submersible dredge pumps is cited as a major method for the removal of these fine suspended ores.

0570 ________. 1980. "New Zealand to the Rescue," Proceedings, World Dredging Conference, WODCON IX, pp 821-826.

Placer mining dredges have a reputation of being wasteful in both recoverable material lost and power consumed. A new bucket ladder dredge, the Grey River No. 1, has been designed to be less wasteful of product material and more energy efficient. Article discusses problems of older gold and tin dredges and compares the Grey River No. 1 designed to correct these problems.

0571 CLIFT, D. S. L. 1975. Gold Dredging in New South Wales, Australian Department of Mines, New South Wales.

Author has compiled all references contained in the libraries of the Geological Survey of New South Wales concerning gold dredging. Book comprises production details listed company by company showing for each year of operation the ounces of gold recovered and cubic yards of material dredged. Early dredging methods are also described. Author concludes that there are many potential gold-dredging areas in the State. The majority of operations would probably be more suited to small-scale pump and suction dredges, at times in combination with earth-moving equipment.

0572 COMBE, A. J. and WATTS, G. M. 1976 (Jan). "Response of Carolina Beach Inlet to a Deposition Basin Dredged in the Throat," Proceedings, Speciality Conference on Dredging and Its Environmental Effects, ASCE, pp 719-735.

Tidal inlets change with time as a result of the relationship between sand (littoral materials) available for transport and transporting agents (tide and wave induced currents). Any tidal inlet, influenced by adjacent littoral material movement, is generally in a state of dynamic change, the response being related to waves, currents, and quantity of littoral materials supplied. Reasoning that the bar channel over the ocean bar would deepen if the quantity of material available within the inlet for resuspension by ebb tidal currents was reduced by catching material in a sediment trap, a deposition basin was dredged in the throat of the uncontrolled inlet at Carolina Beach. Optimum use of dredged material was effected by placing it on the shores downdrift from the inlet. Three dredging cycles and eleven hydrographic surveys have revealed that the inlet responds to the presence of the trap, but a quantitative relationship between deposition basin size and resulting channel width, depth, and alignment has not been reached.

0573 CORD-RUWISCH, O. and LUDERS, E. K. K. S. 1975 (Oct). "The Clearance of Solid Materials from Beds over Which Water Flows," British Patent No. 1408393.

In the conventional method of clearing silt from water channels and removing mud from the sea bed in tidal areas, deposits are simply dug up and transported elsewhere by a dredging ship; an expensive operation. Present device, which may be towed to the working location, includes a sledgelike frame on runners, with two plates extending between the runners. One plate provides a cutting edge and the other is a guide member. Agitation chambers are provided which are parallel with the runners. Nozzles deliver compressed air or a compressed air/water mixture into the chambers. As the framework is moved over the bed, cutters lift solid material from the bed into the chambers. In the chambers, jets of pressurised air break sediment into small particles which are carried away naturally by flow of water along the channel.

0574 COSTANTINI, R. 1961. "Basic Considerations for Long-Distance Solids Pipelines in the Mineral Industry," Transactions, Institute of Mining and Metallurgy, Vol 220, pp 261-270.

Author discusses the future of pipelines for transportation of ore slurries over long distances, citing existing installations. Various criteria and factors affecting use and size of pipelines are considered. Among the factors influencing the use of pipelines are particle size, specific gravity, abrasiveness, minimum velocities, and pumping considerations.

0575 CRAWFORD, P. R. and FROWD, J. R. 1976. "16 Million Tons in Five Years," Department of Harbours and Marine Port of Brisbane Division, Queensland State Government, Australia.

Article describes trailing suction dredge "Sir Thomas Hiley." Equipment, operations, and maintenance features are described in detail. Evaluation of dredging performance was outlined along with some of the dredges' more notable achievements.

0576 D'ANGREMOND, K. ET AL. 1978. "Assessment of Certain European Dredging Practices and Dredged Material Containment and Reclamation Methods," Technical Report D-78-58, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

A study was made of dredging practices, reclamation methods, and environmental effects of dredging in western Europe by visiting more than twenty ports in six countries and discussing pertinent matters with knowledgeable authorities at each port. A remarkable similarity of dredging practices, reclamation methods, and dredging equipment was noted among the European ports. Conventional and special dredging equipment is described and contamination of dredged material and environmental effects is discussed in detail.

0577 DAVISON, C. N. 1962 (Dec). "Concentration and Hydraulic Transport of Heavy Mineral Concentrate with Automatic Control," Proceedings, Australian Institute of Mining and Metallurgy, No. 204, pp 1-57.

Titanium and Zirconium Industries Pty. Ltd. separates rutile and arcon from heavy mineral concentrate recovered from sand dunes on the east coast of North Stradbroke Island, Queensland. Separation plant feed is delivered to Dunwich, on the west coast, by a seven mile aerial ropeway traversing the island. Mining and concentration is effected by two floating dredge-concentrators now operating on the beach 3-1/2 miles from the aerial ropeway terminal. Heavy mineral concentrate is transported hydraulically from dredges to the ropeway through a 6 in. pipeline. Six pumps in series deliver 24 tons/hr of slurry solids in a pulp containing 13 percent solids. For maximum economy, transfer pumping system is controlled deliberately to cause transportation in the zone of incipient settlement of solids, i.e. at velocities below the limited deposit velocity for the particular pipe diameter, pulp density, and specific gravity of solids. Automatic density control, based on a combination of power consumption and pipeline pressure, eliminates the danger of line plugging but periodic flushing is necessary to remove gradual accumulation of solids in the bottom of the pipe. After 15 months operation, pipeline was descaled with hydrochloric acid to remove severe blistering with rust nodules, regrowth of which is now prevented by continuous injection of inhibitors. After transporting 100,000 tons of heavy minerals the average wear on steel portion of the pipeline was 0.01 in. and indications are that wear on asbestos cement portion is less.

0578 DEAN, R. G. and WALTON, T. L. 1975. "Sediment Transport Processes in the Vicinity of Inlets with Special Reference to Sand Trapping," Estuarine Research, Vol 2, pp 129-149.

Method is described and applied for calculating the materials accumulated in outer shoals adjacent to inlets. The calculated outer

shoal accumulations are presented for twenty-three Florida inlets. Calculated volumetric accumulations in inner bars and shoals are presented for four Florida inlets. One conclusion of this study is that stabilization of inlets, particularly in areas of low wave energy, results in an offshore shoal of continuously increasing volume.

0579 DE KONING, J. 1971 (Jun). "Apparatus for Loading a Hopper of a Suction Dredger with Sand," U. S. Patent No. 3878946, Secretary of the Army, Washington, D. C.

In loading a hopper of a floating suction dredger with sand, a sand and water suspension is pumped into the hopper. After hopper is filled to its maximum permissible carrying capacity, additional suspension is pumped into the hopper concurrent with draining excess water from the hopper. Hopper is substantially loaded at its maximum permissible carrying capacity.

0580 DEMENT'YEV, M. A. 1975 (Jan-Feb). "Internal Friction and Lateral Particle Interaction in High-Density Slurry Flows," Fluid Mechanics - Soviet Research, Vol 4, No. 1, pp 17-28.

General description is presented of slurry flows of granular material in small amounts of liquid. Formulas are derived for the internal friction and for transverse interaction of homogeneous nondeformable grains in the slurry flow with shear under two limiting (quasi-laminar and quasi-turbulent) conditions. Theoretically derived formulas are compared with experimental data of Bagnold, so as to verify and define the probability functions of granule contacts and transport efficiency of the slurries.

0581 DENNING, R. A. 1965 (Dec). "Apparatus for Optimizing Dredge Production," Patent No. 3224121, Commissioner of Patents, Washington, D. C.

Patent describes metering and control devices designed to regulate production output of suction dredges.

0582 DIEPERINK, F. J. H. and DONKERS, J. M. 1978 (Mar). "Cassiterite Deposits near Pulua Tujuh, Indonesia, and Equipment Developed for Their Mining," Proceedings, Oceanology International '78, SUT, pp 16-21.

Article describes project with a capacity of 8,500,000 m^3/yr in prevailing sea conditions. Basic design options included a conventional bucket dredger, a bucket dredger with flexible suspended ladder, and a suction dredger with bucket wheel excavator with flexible ladder. All three were analyzed for expected performance and capital and operating costs.

0583 DIGEORGE, F., HERBICH, J. B., and DUNLAP, W. A. 1979 (Oct). "Laboratory Determination of Bulking Factors," Proceedings of the Eleventh Dredging Seminar, Texas A&M University Center for Dredging Studies, Paper No. 15, pp 311-366.

Paper presents the results of a laboratory determination of bulking factors for 27 different soil samples representing a variety of consolidated sandy and silty clays typical to the Texas coastal area. Sedimentation tests were conducted in 1000 ml graduated cylinders and observed for periods ranging from 5 to 30 days. The effects of varying cylinder size and water salinity were also investigated. The results indicated that bulking factors decrease with increasing water salinity, and that significant flocculation of soil particles occurs at water salinities as low as 13%. Equations are derived from the data presented, and relate bulking factors to such soil variables as containment area average void ratio, percent silt and clay, in-situ water content, and Atterberg limits.

0584 DITMARS, J. D. and MCCARTHY, M. J. 1975. "Particle-Laden Jets with Application to Ocean Dumping," Proceedings, 2nd Annual Symposium on Modeling Techniques, ASCE, Vol 1, pp 335-351.

Applicability of single-phase buoyant jet models for the prediction of the gross features of particle-laden jets discharged into coastal waters is considered. Laboratory experiments of a continuous discharge into a stagnant, uniform density receiving water were performed for a saltwater jet and three particle-laden jets, all with the same densimetric Froude number. Study indicates that the spreading of particles is less than that of momentum for large values of the ratio of particle fall velocity to jet discharge velocity.

0585 DIXON, F. S. 1965. "Dredging," Technical Memorandum 1/65, Scripps Institution of Oceanography, Division of Oceanic Research, La Jolla, Calif.

Dredging has been carried out on research vessels of the Scripps Institution of Oceanography for the past 15 years for the purpose of sampling rock from seamounts and ridges and mud from bottom areas. Two types of dredges are used: the chain dredge and the mud dredge.

0586 DOBRONRAVOV, S. S. and KLIGE, N. N. 1973. "Calculation of the Optimum Number of Buckets at the Face for a Rotor Ditch Excavator," Izvestia Vysshikh Uchebnykh Zavedenii, Mashinostr, No. 9, pp 117-122.

The problem of choice of optimum number of buckets on the rotor of a ditch excavator to improve the smoothness of the operation of the rotor, and possibly to maintain high efficiency which falls rapidly with a great increase in the number of buckets is considered. It is shown that these requirements are best met by rotors with the number of buckets from 8 to 16.

0587 DODGE, D. W. and METZNER, A. B. 1959. "Turbulent Flow of Non-Newtonian Systems," Journal, AICE, Vol 5, p 189.

Theoretical analysis for turbulent flow of non-Newtonian fluids through smooth round tubes has been performed and has yielded a

completely new concept of the attending relationship between pressure loss and mean flow rate. In addition, analysis has permitted the prediction of non-Newtonian turbulent velocity profiles.

0588 DODMAN, E. J. 1978. "Underwater Tracking and Dynamic Positioning in Deep Sea Mining Applications," Proceedings, Oceanology International '78, Tech Session C, pp 41-42.

Article describes acoustic positioning in deep water. Use of such a system is envisioned for deep ocean mining dredges and ground-crawling vehicles. Possible plans are presented.

0589 DOMANEVSKII, N. A. 1965/1971. Dredging.

Book contains a description of dredge models; presents information on current organization of dredging projects, manufacturing technology and explosive channel purification and diving work for the improvement of navigable conditions in inland waterways. Current research in the dredging field and experience of the foremost dredge production specialists was utilized in the text compilation.

0590 DONKERS, J. M. 1979. "Equipment for Offshore Mining," Proceedings, International Seminar on Offshore Mineral Resources, pp 275-295.

Paper discusses the historical development of offshore mining dredgers from inland dredgers, and the need for new approaches as mining operations are going further offshore and into less protected waters. Paper describes the development of a light-medium pumping system for greater depths to be used in the future, and also mentions a new system for collecting and transporting to the ocean surface manganese nodules from depths up to 5000 m.

0591 DONKERS, J. M. and HADJIDAKIS, A. 1967. "A Dredge Builder's View of Automation," Ports and Dredging, No. 55, pp 4-10.

A description of IHC Hollands progress in automation of dredge operations is given. Documentation of swell compensators, draft measurement tubes, vacuum, flow rates, cutterhead, and dredge positions, and production indicators is included.

0592 DRISKO, R. W. and DRELICHARZ, J. A. "Urethane Foam Floats for Dredge Pipe," Final Report 7101-7106, National Civil Engineering Laboratory, Port Hueneme, Calif.

Feasibility of using urethane foam floats as replacements for conventional steel dredge pipe floats was investigated. Material and design requirements were determined, and two 1/8-scale models were fabicated. It was concluded that a full-scale model of a float of this design could be fabricated by personnel at a remote location with limited knowledge of materials and equipment for foaming operations but that only in-service testing of a prototype model fabricated in the

field would indicate whether it would be able to satisfactorily withstand the severe conditions encountered in actual use.

0593 DUNN, J. L. 1968. "Use of Digital Computers in Dredge Design," Proceedings, World Dredging Conference, WODCON II, pp 650-676.

Paper describes three applications of computers for dredge design: height trim analysis, structural analysis, and simulation. Author contends that nine other applications are now state-of-the-art while other applications are being developed.

0594 EDGERTON, H. E. and HAYWARD, C. G. 1964. "The 'Boomer' Sonar Source for Seismic Profiling," Journal of Geophysical Research, Vol 69, No. 14, pp 3033-3042.

The boomer, an electromagnetically driven sound source for seismic profiling, consists of a triggered capacitor-bank that discharges through a flat coil or coils. Eddy currents are induced in aluminum plates that are held against the coil by heavy springs or rubber bumpers. Plates are violently repelled, and a cavitation volume is produced in the water which acts as a source of low-frequency sound. Boomer has been used as the transmitter of a continuous seismic profiling system at sea. A 1000-joule system has been used in shallow, fresh and salt water. Reflections from sediment layers at least a kilometer below the bottom of the Puerto Rico trench have been recorded.

0595 EL-GHAMRY, O. A. and GUPTA, R. P. 1971 (Sep). "Gas Removal System Study of the Horizontal Discharge Pumps," Report No. 310.23, Lehigh University, Fritz Engineering Laboratory, Bethlehem, Pa.

Objective of investigation was to study effect of changing the discharge pipe orientation on the dredge pump tolerance to an entrained gas content in the flowing fluid. System performance under various conditions of air content, pump speed, air removal systems, and discharge orifice setting was investigated.

Comparison with previous test results on the model pump with vertical discharge pipe showed that: (a) with removal system inactive, system performance was essentially the same in both cases, and (b) for the top horizontal discharge pump, smaller percentages of air removal were obtained and collapse points occurred at lower air percentages.

0596 ELLINGTON, R. C. 1976 (Sep). "Preventive Maintenance Pushes Productivity," World Dredging and Marine Construction, Vol 12, No. 10, pp 34-36.

Periodic oil analysis for diesel engines and on-site contamination control for the other oil systems of tow boats and dredges are recommended.

0597 EMMER, R. E. 1978. "Upstream Limits of Section 404 Federal Jurisdiction," Proceedings, Coastal Zone 1978, ASCE, Vol 3, pp 2013-2025.

Federal jurisdiction of dredge and fill activities in watercourses has caused much controversy since the enactment of the Federal Water Pollution Control Act Amendments of 1972. One of the problems has been defining the upstream limit of federal jurisdiction, a line which was once based on the extent of interstate trade but through the FWPCA was changed to mean a line where the average flow was 5 cfs. Neither line is satisfactory. A line determined by the use of the water as a

resource is more satisfactory for protecting waters that enter the coastal zone because it continues federal protection of the natural systems while eliminating excessive federal regulation. This method is mappable as has been shown and is a flexible method that allows protection to expand or contract in response to the dynamic relationship of man and water.

0598 ERINOSO, A. O. 1980 (Oct). "Some Capital Dredging and Reclamation Works Undertaken by Nigerian Ports Authority," Proceedings, World Dredging Conference, WODCON IX, pp 923-935.

Brief summary is given of the Capital Dredging and Reclamation Works that were undertaken by the Nigerian Ports Authority between the years 1975 and 1979. The Capital Dredging and Reclamation Works formed part of the overall 550 million Port Development Construction Programme that was executed by the Authority during the same period. It is shown that a total volume of about 95 million cubic metres of materials was dredged in executing various main-line Port and Lighter Terminal Projects.

0599 EWING, R. C. 1974 (Jan). "One of the Most Advanced Cutter Barges Christened," Oil and Gas Journal, Vol 72, No. 3, pp 64-65.

Described as one of the largest, most advanced cutter dredges, the vessel, christened the "Jim Bean," can work inland or in ocean environments with up to 7-ft seas.

0600 FARIS, W. M. 1974. "Admiralty Problems to Dredging and Pollution Internationally," Proceedings, World Dredging Conference, WODCON VI, pp 177-195.

Article discusses civil liability on dredge operators due to water pollution resulting from dredging operations. Numerous court cases and laws concerning dredging effects are cited. Guidelines are presented and future trends predicted.

0601 FELLERER, R. 1975. "Some Technical and Economical Aspects of Deepsea Mining," De Ingenieur, Vol 87, No. 34, pp 654-661.

General areas for managanese nodule mining and average composition of nodules is given, as well as mining of nodules (incl. description of methods like mechanical continuous dredging and pipe-string methods); environmental impacts; and economic aspects of deepsea mining.

0602 FERRIER, R. and NORWOOD, J. 1979 (Mar). "Selecting an Electric Dredge Power and Control System," World Dredging and Marine Construction, Vol 15, No. 3, pp 22-25.

Ideal control parameters of the dredge's major variable speed loads (hoisting winches, pumping, cutter drive, swing drive, spudding winches, and propulsion) are given and these are compared with performance capabilities of the 2 types of electric motors - the AC wound rotor motor and the DC motor. The following conclusions about the application of electric drive systems for dredging have been reached: hoisting winches work best using wound rotor motors with a resistor-type controller; pumping functions should use the wound rotor motor with the SCR converter controller; cutter drive should use the DC motor; swing drive should use the wound rotor motors with resistors drive below 150 hp. DC motors above 150 hp; spud winches have horsepower ratings that typically require the wound rotor motor with resistor controller or DC motors; and propulsion requires rapid reversing and speed control, so the SCR system driving the DC motor is best.

0603 FIGUEIREDO, O. and CHARLES, M. E. 1967 (Feb). "Pipeline Processing: Mass Transfer in the Horizontal Pipeline Flow of Solid-Liquid Mixtures," Canadian Journal of Chemical Engineering, Vol 45, No. 1, pp 12-16.

Experiments have been performed to determine mass transfer coefficients for dissolution of sodium chloride particles carried as a "settling" suspension in a horizontal pipeline. Coefficients obtained for two sizes of particles, along with other coefficients available from literature for different systems, have been correlated with an average deviation of only 7% by making use of Durand's equation for predicting pressure gradients for flow of "settling" suspensions and the analogy between momentum and mass transfer.

0604 FLIPSE, J. E. 1969. "An Engineering Approach to Ocean Mining," Preprints, Offshore Technology Conference, Paper No. 1035, pp I-318-I-322.

Paper presents rationale for and conclusions drawn from several years of exploration, research, engineering studies and engineering design addressed to problems of exploiting manganese nodule deposits in the deep oceans. Methodology and hardware developed during this project have been disclosed in a cohesive family of U. S. patents, most of which have already been issued. Author believes that the final success of underwater mineral exploitation lies in imaginative, thorough development of conventional engineering techniques rather than in new and highly sophisticated devices.

0605 FLITCROFT, K. W. 1970 (Jun). "Mammoth Dredging Project at Antwerp," The Dock and Harbour Authority, Vol 51, No. 596, pp 81-83.

Preparation of the three basins for the canal dock at Antwerp, the 7th dock and the approach channel to the Zandvliet maritime lock, required 95 million m^3 of spoil to be dredged. Maintenance dredging is also described.

0606 FOWKES, E. P. and WANCHECK, G. A. 1969. "Materials Handling Research Hydraulic Transportation of Coarse Solids," Report of Investigation 7283, U. S. Dept. of the Interior, Bureau of Mines.

The Bureau of Mines constructed a fully automated pilot plant facility to study hydraulic transportation of solids through a lock hopper feeder system. An equation for energy requirements to transport coarse solids hydraulically proved applicable to this system. Optimum velocities were obtained for limestone, mine refuse, and bituminous coal. Experimental data, calculations, and graphs show effect of velocity, specific gravity, and solids concentration on head loss and power requirements. Other data were obtained and evaluated to determine effect of particle size on head loss. Results also are given for (a) tests using friction reducing polymers; (b) tests using seven test sections of steel alloy pipe to determine their wear characteristics; (c) tests to determine spatial segregation of moving particles; and (d) tests to determine effect of shape, size, and specific gravity on particle velocity in a horizontal pipeline. The lock hopper feeder system was found practical for continuous hydraulic transportation of material types and size ranges tested.

0607 FRANCISCUS, H. and WOLTERS, T. A. 1977 (Nov). "Method and Device for Sucking Up a Solid Substance from a Stock," British Patent No. 1493503.

Invention is intended for removing by suction one fraction of solid materials from a stock of materials consisting of several sizes and fractions and is presented as an improvement to known designs. A means of regulating the specific weight of the stream of required solids and water is described.

0608 FRANK, W., CUNDY, D. F. and TRAMONTANO, J. M. 1979 (Dec). "Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations," Estuarine and Coastal Marine Science, Vol 9, No. 6, pp 699-711.

Field sampling of suspended material field downstream of a large volume bucket dredger operating in the Lower Thames River estuary near New London, Connecticut, was conducted in order to examine the magnitude and character of dredger-induced resuspension and to evaluate typical operational efficiency. These data indicate that approximately 1.5 to 3% of sediment volume in each bucket-load is introduced into the water column producing suspended material concentrations adjacent to the dredger of 200 mg L^{-1} to 400 mg L^{-1}. These values exceed background levels by two orders of magnitude.

0609 FRAZIER, D. M. 1968. "Improvement of Material Handling Techniques for Long Pipelines," Proceedings, World Dredging Conference, WODCON II, pp 639-649.

Cost comparison of pipeline transportation, improved pumping techniques, varying throughput from dredge to pipeline, and concentration of slurries for cost reduction are given.

0610 FRAZIER, W. G. 1967 (May). "Development of a Dredge Jet Pump," Proceedings, World Dredging Conference, WODCON I, pp 517-534.

Deep water dredging (200 ft) in Ghana, Africa, to construct a dam necessitated the design and construction of an underwater booster pump system to aid the dredges main centrifugal pump. Research, design, and fabrication of the jet pump are described. Results of use are not included.

0611 FREDSOE, J. 1977 (Aug). "Settling of Suspended Sediment in Dredged Regions," Institute of Hydrodynamic and Hydraulic Engineering, Progress Report No. 43, pp 3-6.

Article presents a theoretical analysis of sedimentation rates of natural backfill to regions which have been dredged in order to place pipelines below the bed in the North Sea.

0612 GAGE, J. D. 1975 (Oct). "Comparison of the Deep-Sea Epibenthic Sledge and Anchor-Box Dredge Samplers with the Van Veen Grab and Hand Coring by Diver," Deep Sea Research, Vol 22, No. 10, pp 693-702.

A comparison is made of benthos samples obtained with the different samplers from a soft mud bottom in a sheltered sea-loch in west Scotland. Except for that obtained from the epibenthic sledge, the samples were faunally very similar to each other.

0613 GARCIA, A. W. and PERRY, F. C. 1976 (Oct). "Beach Nourishment Techniques; Report 2, A Means of Predicting Littoral Sediment Transport Seaward of the Breaker Zone," Technical Report H-76-13, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Method of determining, as a function of water depth, the amount of sediment entrained into the longshore current regime seaward of the breaker zone is developed and presented, objective being the nourishment of beaches by offshore dumping of sediment such as by hopper dredger. Summary and general description of previous related investigations are included. Wave hindcast data compiled by National Marine Consultants for the years 1956, 1957 and 1958 were used as input to the method for verification purposes. Site of verification was Point Pedernales, California. Figures showing computed and measured longshore sediment transport are included for comparative purposes.

0614 GEE, H. C. 1965 (Aug). "Beach Nourishment from Offshore Sources," Journal, Waterways and Harbors Division, ASCE, Vol 91, No. WW3, pp 1-5.

Jupiter Island, Florida, suffered severe damage to its ocean front in 1962. Heavy swells in March and Northeast storms in November and December removed most of the material from the ocean beach and exposed bulkhead walls to severe wave attack. Emergency dredging was used to place 60,000 yd of material on the beach, structures were reinforced by use of granite boulders and construction of groins, but the problem of continuing beach nourishment was solved in a unique manner. A dragscraper was used to excavate material from the offshore bottoms, a distance of 800 ft seaward of ordinary high water. This beach nourishment program from offshore sources has been in progress for two summers; results to date (1965) are encouraging.

0615 GENDRE, A. and LESPINE, E. 1969. "Latest Developments in the Design and Operation of Dredging Equipment, in Particular as Regards Suction Dredging in Very Deep Water," Proceedings, 22nd International Nav. Congr., Sec. II, Subj. 2, pp 43-64.

Dredging means must be adjusted to obtain depths in the navigation channels, in order to allow entry of vessels with growing drafts.

Hopper dredges especially must be able to operate in areas exposed to swell and at depths that will soon be about 35 m. Paper recalls consequences of such depths on the conception of the pumping means.

0616 GENINI, M. 1979 (Oct). "A Solution for the Development of Deep-sea Mining Operations," Proceedings, International Seminar on Offshore Mineral Resources, pp 513-519.

A new generation of high performance flexible pipes manufactured in large diameters and long continuous lengths are described. Future use in offshore mining is discussed.

0617 GIBSON, G. T. and SIMPSON, E. C. 1972. "Bartow Maintenance Dredging: An Environmental Approach," World Dredging and Marine Construction, Vol 8, No. 13, pp 54-60.

In the Bartow maintenance dredging scheme, 3 methods were incorporated: hydraulic dredging equipment, silt retention devices, and planned spoil retention areas.

0618 GROENVELD, H. L. 1971. "Hopperdredge Draghead Bottom-Pressure Variations Due to Relative Ship's Motion," Proceedings, World Dredging Conference, WODCON IV, pp 697-718.

A simplified analysis of ship motion is used to predict drag pressure of a draghead. Fluctuation of this pressure is defined in terms of the suspension system mechanical properties and suction pipe geometry. Design considerations to reduce the draghead pressure are recommended.

0619 GUERIN, P. 1980 (Mar). "Port of Fos Progress Made in Dredging During the Last Five Years," Proceedings, Third International Symposium on Dredging Technology, BHRA, Paper D-4, pp 209-215.

Article describes dredging in the Port of Fos in which 100,000,000 m^3 were dredged. Use of a powerful cutter suction dredge with advanced electronic instrumentation and the draining of muddy materials used for embankments of terraces are discussed.

0620 GUNTERT, R. M. 1974 (Jul). "Improvements in or Relating to Dredge Chains," British Patent No. 1467185.

A 'hinge type' drag chain for driving dredge buckets of an endless bucket line is described. The advantage of this is that it enables the chain-supporting system above the dredge barge to rock with the barge while the portions below the barge will remain in a substantially vertical plane during a dredging operation.

0621 GUSTAFSON, J. F. 1973 (Dec). "Eutrophication--A Dredging Problem," World Dredging and Marine Construction, Vol 9, No. 14, pp 42-47.

Eutrophication caused by dredging operations is discussed. Author explains what it is, what causes it, how to gather information relating to it and offers suggestions for future cures.

0622 HAIST, G. and MILBURN, B. 1980. "Dredging Reduces Costs of Developed Residential Land in Northern Canada," Proceedings, World Dredging Conference, WODCON IX, pp 111-124.

A 600-mm cutter suction dredge was used to place 80,000 m^3 of sandy material in eight days into a low lying area which had been identified as a potential subdivision location. Completed cost of this subdivision area is anticipated to be 50% less than if surficial soils had been hauled and placed by conventional methods.

Dredging has a potentially promising future for residential development in North Canada. Success of this operation, both economically and technologically, has stimulated thought as to the use of dredging for additional residential developments and as a competitive method for constructing water reservoirs.

0623 HALLIWELL, R. and O'CONNOR, B. 1974 (Jun). "Quantifying Spoil Disposal Practices," Proceedings, Fourteenth Coastal Engineering Conference, ASCE, pp 2581-2600.

Results of an extensive field study undertaken in the Mersey Estuary and its approach channels are briefly described. Measurements were taken to obtain a quantitative understanding of the movement and circulation of water and sediment in the area. There is considerable dredging activity required and spoil from such operations is, at present time, deposited at an offshore site in Liverpool Bay. A simple model is presented which attempts to quantify the movement of sediment into and within the Mersey system. Field measurements showed that considerable quantities of sediment return to the docks, estuary and approach channels from the spoil ground. Model includes this fact and attempts to quantify amounts returning to various areas. Model equations were applied to each year of the period 1955-65 to determine various factors and to test its validity; this required use of the annual hydrographic surveys and dredging records as well as field measurement results. Finally, model was used to compare probable results of a number of possible schemes including re-siting of the spoil ground, pumping all dredged material ashore and free-dumping of dock dredgings in the estuary itself.

0624 HAMMOND, R. 1969. Modern Dredging Practice, Frederick Muller, London.

The importance of dredging; grab, bucket and suction dredgers; position fixing and sounding; dredging research; scale-model research; dredging practice; and ancillary craft for dredging are all covered.

0625 HANN, R. W. and HUTTON, W. S. 1970. "Organic Sludges in the Houston Ship Channel: Their Source, Nature, Effect, and Removal," Proceedings, World Dredging Conference, WODCON III, pp 247-272.

Pre and post-dredge surveys were used to determine sedimentation patterns in the Houston Ship Channel, Texas. Analysis of the deposited material also helped researchers to determine the amount of organic material removed from the estuarine system as bottom deposits.

0626 HANCOCK, N. 1976 (Dec). "Floating Excavators Raise Productivity in Major Dredging Projects," Engineering Contract Record, Vol 89, No. 12, pp 22-23.

Author reports on a new type of floating dredger which can be anchored and moved by hydraulically actuated spuds, that offers high productivity over tenacious soils due to its high crowd forces, large bucket and great working depth.

0627 HARDY, O. 1967 (Sep). "Cutting the Cost of Port of Manchester's Dredging," Dock and Harbour Authority, Vol 48, No. 563, pp 142-146.

Author describes a number of techniques and devices which have cut the annual dredging bill of the port of Manchester by more than a third. Underlying principle behind methods is assisting nature to clear bottom of channels with minimum use of expensive conventional dredgers. Among others he describes a method to use locks for maintaining entrance channels at the required depth.

0628 HARMSTORF, R. 1969. "A Pipeline Lowered to the Bottom of a Water Course Is Buried," Netherlands Patent No. 69,00483, American Petroleum Institute, New York, N. Y.

Article describes device for burying a pipeline in the ocean. Device uses liquid or gas media discharged through flushing chambers and nozzles on the apparatus.

0629 HARRIS, D. 1979. "Dredging the Panama vs the Suez: Unique Problems Facing Each of These Water Passages to the World," Proceedings, Eleventh Dredging Seminar, Texas A&M Center for Dredging Studies, Paper No. 11, pp 208-220.

The Panama and Suez Canals presented an early large-scale application of modern dredging techniques. Dredging continues to play an important role in the maintenance and expansion of both canals, and each has its own particular set of problems. The desert still tries to cover the Suez; in Panama, silting and slides keep dredger crews busy. In this paper, comparisons and analyses of geological, technical, and financial problems of the two canals are presented.

0630 HARRIS, E. G. 1980 (Jul). "Ecological Dredging of Inland Waters," Terra et Aqua, No. 19, pp 2-6.

Problems encountered in small inland dredging projects, such as lake maintenance, are outlined.

0631 HART, E. D. and DOWNING, G. C. 1977. "Positioning Techniques and Equipment for U. S. Corps of Engineers Hydrographic Surveys," Technical Report H-77-10, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Hydrographic survey positioning equipment (electronic, acoustic, and optical) described was known to be available at time of publication. Information regarding commercial equipment was obtained through continuous monitoring of appropriate literature and through telephone conversations with and personal visits to private firms involved in development and sale of hydrographic surveying equipment. Knowledge of techniques in use within the U. S. Army Corps of Engineers (CE) was obtained in conversations with Survey Branch personnel from CE Districts in various parts of the country.

0632 HAYWARD, H. G. A. 1960. "Improvement Program for Hopper Dredges and Hopper Dredging," Marine Division, U. S. Army Engineer Division, North Atlantic, New York, N. Y., pp I1-1 - IX-1.

Report reviews ongoing program to study hopper dredge problem areas. Particular emphasis is on pump impeller design, hopper distribution systems, and electronic positioning. Past performance and recommendations for improvements are detailed.

0633 HAYWARD, R. K., MOON, J. G. and PALMER, D. J. 1980. "The Selection of Plant and Contract Arrangements for a Very Large Negotiated Dredging Contract in the Middle East," Proceedings, Third International Symposium on Dredging Technology, BHRA, Paper A-2, pp 13-27.

Construction of the new port at Jebel Ali, Dubai, United Arab Emirates, involved excavation of some 110 million m^3. It was a requirement that the first five deepwater berths should be open to shipping, albeit with some draft limitations, within 18 months and that the whole works should be completed within 5-1/2 years. Paper describes how these problems were overcome; the manner in which existing plant was deployed on the project; decisions which led the authority to build and bring into operation new plant (including the world's first self elevating cutter suction dredger, 'Al Wassl Bay') and the conclusion of a negotiated contract incorporating payment and other conditions which, whilst retaining ample productivity incentives, safeguarded financial interests of both employer and contractor against uncertainties of ground and weather conditions.

0634 HEIJMAN, L. 1968. "Some Soil Mechanical Aspects of Winning Sand at Great Depths and Making Sand Fills Overlaying Poor Subsoils," Proceedings, World Dredging Conference, WODCON II, pp 596-603.

Subject of paper is to comment on some of the specific difficulties related to the winning of sand and execution of hydraulic sand fills on large areas for town and harbor extensions in the Western part of the Netherlands. Subsoil conditions are described in detail.

0635 HEMMINGS, S. K. 1975. Dredging Technology, British Hydromechanics Research Association, Cranfield, Bedford, England.

Papers are presented on the theoretical and practical aspects of dredging operations, including equipment, economics, and performance. The economics of dredging sand and gravel for aggregate are explored, and methods of spoil disposal are compared. Problems discussed include transportation, particularly in hydraulic pipelines, abrasion-resistant alloys for pumps, and siltation in dredged channels. Other topics include estimation of need, yield, measurement parameters, spoil disposal, dispersion, loading, and dewatering.

0636 HENY, R., CASTILLO, F. P., and MARCUCCI, E. 1974. "Planning and Construction of a Sand Dike Improving the Maracaibo Navigation Channel at the Estuary Mouth," Proceedings, World Dredging Conference, WODCON VI, pp 477-503.

Severe shoaling in the entrance of Tablazo Bay, Venezuela, prompted the study of possible corrective measures. Article describes the planning process, model and field tests conducted, and actual construction of a sand dike to alleviate the shoaling problem. A hydraulic cutterhead dredge was used to dredge 680,000 cubic meters of material for the dike construction. Future improvements are suggested along with an analysis of the project's success.

0637 HERBICH, J. B. 1959. "Characteristics of a Model Dredge Pump," Report No. 277-P.R., Lehigh University, Fritz Engineering Laboratory, Bethlehem, Pa.

Study was initiated to improve design of a hopper dredge centrifugal pump for pumping silt-clay-water mixtures.

The first part of the study involved installation and testing, in the hydraulic laboratory, of a 1 to 8 scale dredge pump model used on hopper dredge ESSAYONS. Water, as well as a silt-clay-water mixture, was pumped, and complete characteristics of the pump obtained for flow of 0 to 1200 gallons per minute, speed of 1150 to 1900 revolutions per minute, and liquid concentrations of 1000 to 1320 grams per liter.

0638 __________. 1968. "Deep Ocean Mineral Recovery," Proceedings, World Dredging Conference, WODCON II, pp 723-733.

Article covers sources of marine minerals, dredging methods of draglines, submarines, undersea tractors, suction dredging, light-weight liquid lift system, environemntal factors, and hazards of operation all relating to deep ocean mineral recovery.

0639 __________. 1968. "Research Needs of Dredging Industry," Proceedings, World Dredging Conference, WODCON II, pp 698-710.

A brief discussion of research needs in dredging which are subdivided in the following groups: (1) dredging machinery, (2) discharge pipe distribution systems, (3) special machinery, (4) quantity measurements, and (5) flow of slurries in pipelines.

0640 HERBICH, J. B. 1974. Proceedings of the Sixth Dredging Seminar, CDS-176, TAMU SG-74-104, Sea Grant College Center for Dredging, Texas A&M University, College Station, Tex.

Contains 8 papers on dredging related to flood protection, dredge slurry disposal, systems engineering, specifications, and shell dredging related to environmental protection.

0641 ________. 1977. Second International Symposium on Dredging Technology, U. S. National Science Foundation, Washington, D. C.

Conference on dredging included presentation of lectures on recent research, state-of-the-art, workshops and discussions. There was a special panel on the environmental effects of dredging.

0642 ________. 1980 (Oct). "Operating Characteristics of Cutterhead Dredgers," Proceedings, World Dredging Conference, WODCON IX, pp 191-202.

Survey was made to evaluate operating characteristics of cutter suction dredgers in this country and overseas. The survey was made: (1) to determine physical characteristics of the dredgers; (2) to find out how many are equipped with modern instrumentation; (3) to determine average crew size; (4) to determine estimated percentage of maintenance time required; (5) to find out whether cutterhead dredgers presently owned can operate in waves and swells; (6) to determine the type of pipelines used; and (7) to compare the dredging practices of the U. S. and Canada with those of Europe and Asia. It was discovered that relatively few dredgers are able to operate under wave conditions over five feet, and that few of the U. S. and Canadian dredgers have adequate instrumentation, but a majority of foreign dredgers have magnetic flow meters, density meters and total production meters.

0643 ________. 1980. Proceedings of the Twelfth Dredging Seminar, Sea Grant College Program, Texas A&M University, College Station, Tex.

Titles of presentations discussed include: Design of Fine-Grained Dredged Material Sedimentation Basins, Measurement and Prediction of Consolidation of Dredged Material, Early Dredging on the Texas Coast, Performance Testing at the Georgia Iron Works Hydraulic Laboratory, Building and Management of Dredged Material Islands for Use by Wildlife in North America, Center for Dredging Studies, Application of the Biotal Ocean Monitor System to In Situ Bioassays of Dredged Material, Contamination of James River Beds Sediments with Kepone, Open-Water Disposal of Dredged Material on Bottom Topography Along the Texas Coast, Physical and Chemical Characterization of Dredged Material Influents and Effluents in Confined Land Disposal Area, Improving the Efficiency of Dredging Several Feet of Contaminated Sediment Off the Top of Uncontaminated Sediment.

0644 HERBICH, J. B., ADAMS, J. R., and KO, S. C. 1969. "Gas Removal System, Part III," Report No. 310.21, Lehigh University, Fritz Engineering Laboratory, Bethlehem, Pa.

Results of the study of gas removal systems for dredge pumps are presented. In addition, a brief study of the effect of gas injection methods is discussed. Air injection studies showed that gas flow behavior is an important factor. Intermittent air slugs were partially removed, and generally caused only a momentary decrease in pump performance.

0645 HERBICH, J. B. and CHRISTOPHER, R. J. 1963. "Use of High Speed Photography to Analyze Particle Motion in a Model Dredge Pump," Proceedings, International Association for Hydraulic Research Congress, I.A.H.R., pp 89-96.

High speed photography was employed to observe and analyze particle motion through the impeller and in the volute casing of a model dredge pump in an attempt to determine the effect of behavior of silt-clay-water mixtures in centrifugal dredge pumps.

Particle movements were photographed at a camera speed of between 6000 and 8000 frames per second through a transparent plexiglas volute casing, suction side head and impeller shroud.

Particle motion was traced on paper from films and the characteristics of motion were analyzed. Comparison was made between observed motion and theoretical pump flow and reasons for any discrepancies were discussed.

0646 HERBICH, J. B. and ISAACS, W. P. 1964. "Gas Removal System; Part I: Literature Survey and Formulation of Test Program," Report No. 310.3, Lehigh University, Fritz Engineering Laboratory, Bethlehem, Pa.

A literature review was made on similar or related work previously performed on gas removal systems associated with dredge pumps. Review is presented in form of abstracts and annotations, and interprets, to the extent practical, all such findings in relation to the dredging process.

A proposed test program is formulated and discussed for carrying out a study of gas removal from dredging suction line in an experimental study.

0647 HERBICH, J. B. ET AL. 1970. "Bibliography on Dredging," Report No. 112-A-CDS, 2d Ed., Center for Dredging Studies, Texas A&M University, College Station, Tex.

Bibliography is divided into: (a) dredge pumps; (b) dredging vessels; (c) ocean mining; (d) pipeline transport; and (e) miscellaneous.

0648 HEROD, J. E. 1973 (Jul). Drag Reduction Effects of Dilute Polymer Additives on Dredge Spoil Pipe Flows, M.S. Thesis, Oklahoma State University, Stillwater, Okla.

Thesis describes feasibility of drag-reducing particular slurry flows by the injection of dilute concentrations of polymer solutions. Dredge type slurries are used to obtain data and to determine feasibility for an actual application.

0649 HESS, W. N. and NELSON, T. A. 1975. "Test Particle Dispersion Study in Massachusetts Bay," Proceedings, 7th Annual Offshore Technology Conference, Vol 1, Paper OTC 2160, pp 119-132.

Development of predictive models to estimate in advance of a dredging operations where the fines in a dredge plume will travel is an important goal. 2700 kilograms (3 tons) of small particles were released into the water column in Massachusetts Bay and their movement tracked for 10 days. Also, oceanographic data were collected and analyzed and a dispersion model was formulated. Final data show plume movement to be west toward Boston Harbor, eastward toward Stellwagen Bank and southward along the coast into Cape Cod Bay where a counterclockwise gyre is suggested.

0650 HILL, J. C. 1970 (Oct). "Unusual Dredging Operation," World Dredging and Marine Construction, Vol 6, No. 12, pp 21, 23.

Article describes how an unusual application of the Amjet pump system of dredging entailed removal of silt from a submerged siphon. The siphon, one of a pair taking river water beneath a canal, was totally blocked by a mixture of heavy silt and refuse. Siphon measured 400 ft in length with a diam. of 12 ft and contained some 1500 cu yd of material to be removed. To remove the material, a 4 in. Amjet pump with a short suction pipe was employed.

0651 HISHI, K. 1976. "Dredging of High-Density Sludge Using Longer Pump," Proceedings, World Dredging Conference, WODCON VII, pp 751-778.

Technical details on a vacuum and water head pressure pump are described. Unit is characterized by its simplicity of operation and the claimed absence of secondary contamination problems in contaminated seafloor sludges.

0652 HOLSTERS, H. 1968. "Dredging Performance at Great Depth in a Tidal River," Proceedings, World Dredging Conference, WODCON II, pp 892-913.

Excavation and maintenance dredging of the "E3-Tunnel" at Antwerp, Belgium, is described. Initial excavation of 1.5 million cubic meters of material was dredged by a bucket ladder dredge. Dredging depth approached 30 meters in some areas. Maintenance dredging was accomplished by agitation, bucket, and plain suction dredges. Excavation sequence is described in detail.

0653 HOMAYOUNFAR, F. 1965. Flow of Multicomponent Slurries, M.S. Thesis, University of Delaware, Newark, Del.

Preliminary review of economic, engineering, and empirical aspects of slurry transportation is followed by report on an experimental investigation carried out to show:

1. The existence of optimum composition of two solid constituents of slurry, which would result in minimum head losses for a given load transported.
2. Also, an attempt to verify the extension of the use of Durand's formula to multicomponent slurries.

Results obtained quantitatively confirm, with reasonable accuracy, existence of an optimum composition; however, modified Durand's equation does not consistently predict head losses of multicomponent slurries.

0654 HOPMAN, R. 1974 (Aug). "Doppler Sonar Navigator System Aids Dredging," World Dredging and Marine Construction, Vol 10, No. 9, pp 22-24.

Three specially modified doppler sonar navigators described have been installed on hopper dredges for the U. S. Army Corps of Engineers in Portland, Oregon. The modifications were to allow shallow depth capability below 8 feet.

0655 HOWARD, C. D. D. 1962. The Effect of Fines on the Pipeline Flow of Sand Water Mixtures, M.S. Thesis, University of Alberta, Canada.

A series of tests in a 2-inch pipeline have been carried out on water, sand-water slurries and fines-sand-water slurries to investigate the effect of the addition of fines on the transportation characteristics of a sand-water slurry.

It is shown that introduction of fines into a sand-water slurry can reduce critical velocity.

Description of test apparatus is included with a detailed discussion on instrumentation which was developed during the research program.

0656 HOWELLS, K. and MCKAY, A. G. 1977 (Dec). "Seismic Profiling in Miramichi Bay, New Brunswick," Canadian Journal of Earth Science, Vol 14, No. 12, pp 2909-2927.

A marine seismic profiling survey was carried out in Miramichi Bay, New Brunswick, as part of the Miramichi Channel Study. Its purpose was to determine surficial sediment thicknesses to plan dredging operations for deepening of a shipping channel. The combined echo sounder and seismic profiling survey in Miramichi Bay detected two prominent seismic reflectors. Upper reflector probably represents a marine terrace, above which are recent sediments.

0657 HSU, Y.-S. 1976. "A Study on Taiwan West Coast Tidal-Land Development by Dredging in Taiwan," Proceedings, World Dredging Conference, WODCON VII, pp 879-904.

Paper describes history and background on the reclamation of tidal land by sand-pump and other equipment in Taiwan, and discusses possibility of doing this work by dredging, problems encountered and approximate cost.

0658 HUFF, W. R., HOLDEN, J. H., and PHILLIPS, J. A. 1965. "Flow Properties of Powered Coal Tar Slurries," Report of Investigation 6706, U. S. Bureau of Mines, Department of Interior.

Yield stress and plastic viscosity values, determined from shear rate-shear stress relationships, were found to be a linear function of coal concentration for coal-water slurries containing 40, 45, 50, and 55 weight-percent of powdered coal. In the laminar region, flow is described by an equation derived from the fact that the square root of shear stress varied linearily with the square root of shear rate. In the turbulent region, friction factor was found to be inversely proportional to velocity to the 0.12 power.

0659 HURST, G. P. and ANDREN, T. 1976. "An Improved Dredge Pump Lines Combining Wear Resistant Rubber with Embedded Steel Mesh," Proceedings, World Dredging Conference, WODCON VII, pp 981-994.

Paper describes a pump liner system that permits use of economical rubber liners even when trash or sharp stones are present in the dredging material. Unique feature of the liner is that multiple layers of high-carbon steel wire mesh are embedded within the rubber where the wire mesh protects the rubber from being torn out by the sharp material.

0660 HUSTON, J. 1968 (Oct). "Some Fundamental Needs of the Dredging Profession," Proceedings, World Dredging Conference, WODCON II, pp 711-722.

Lack of useable literature such as training manuals is cited. Most papers describe specific jobs and equipment which means workers must learn from experience. Paper gives research needs and suggests training programs to alleviate this problem.

0661 ICHIYE, T. and CARNES, M. 1977. "Modeling of Sediment Dispersion During Deep Ocean Mining Operations," Proceedings, 9th Annual Offshore Technology Conference, Vol 1, pp 421-433.

Mathematical models are constructed to predict transport and dispersion of waste sediments from operations of mining manganese nodules in the tropical western Pacific for the DOMES (Deep Ocean Mining Environmental Study) project. Models are also expressed in nondimensional form to be used with arbitrary environmental parameters.

0662 IDE, K., HOSONO, S., and MATSUISHI, H. 1975. "Sea Bed Rock Excavation in Imari Bay," 3rd International Ocean Development Conference, Vol 2, pp 281-290.

Sea-bed rock excavation was performed at revetments and anchorage basin of the Nanatsujima area in eastern Imari Bay. Sea-bed geology and rock excavation were investigated by the Sonoprobe Method before and after sea-bed rock excavation was performed. Authors principally investigated the relation between sea-bed excavation and rock faces on sedimentary rocks.

0663 IRVING, R. 1967. "Instrumentation in Dredging," Proceedings, World Dredging Conference, WODCON I, pp 397-422.

In all flow processes, suitable instrumentation is required for monitoring and control purposes. In particular, where flow process involves solid-liquid mixtures, as in dredging, need is for instrumentation which in addition to yielding required information does not obstruct flow.

Attention is directed at instrumentation used on board the hydraulic dredge and more specifically the trailing suction dredge. Simplified description of the trailing dredge portrays three systems into which dredging machinery may be separated and allows for easy discussion. These systems are the suction, pump and discharge systems.

0664 ISAACS, C. R. 1974 (Apr). "Dredging for Bulk Samples of Manganese Nodules," Mining Engineering, Vol 26, No. 4, pp 27-30.

System for dredging bulk samples of manganese nodules from the deep-ocean floor was developed during 1972. It successfully dredged 200 tons of nodules from a depth of 15,000 ft. Paper describes various components and design features of the dredging system. Comparisons of this system and conventional oceanographic dredging equipment are presented, along with the influence of external factors such as weather and ship characteristics.

0665 ITO, H., MATSUDA, J., and FUSE, S. 1969. "Recent Development of Dredgers in Japan," Proceedings, Twenty-second International Nav. Congr., PIANC, Sec. II, Subj. 2, pp 65-85.

Contents: (1) Drag suction dredging and sea-bottom grading. Dredger and principle of method; (2) Special problems. An operative ship for treating undulation of dredged ditches; (3) Outline of sea bottom grader "Kinryumaru"; (4) Actual results of the "Kinryumaru"; (5) Counter-measures for great depth dredging; (6) Performance and operation record of the Koknei-maru.

0666 IWASAKI, T. 1966 (Sep). "Resisting Torques or Forces Acting on Spuds of Pump Dredger on Surface Waves," Proceedings, Tenth Coastal Engineering Conference, ASCE, Vol 2, pp 1527-1546.

Paper presents analysis on resisting torques and forces acting on spuds mooring dredger for surface waves. Torque or force was expressed by the product of system factor, wave factor and magnification factor.

0667 IWATA, H. 1970 (Jul). "Research on Dredging Grab-buckets," Proceedings, World Dredging Conference, WODCON III, pp 23-63.

Report presents methods of decision of excavated facilities of soil which are dug by grab-buckets, on the determination of well-adopted type of grab-buckets for each soil, and also on digging characteristics of grab-buckets.

Author presents some theories on grab-buckets and applications of these theories for actual dredging operations of grab-dredgers.

0668 __________. 1971. "Study on the Soil to be Dredged and the Mechanism of an Excavation," Report, Port and Harbour Research Institute, Vol 10, No. 3, pp 237-263.

Experimental formulas to obtain jaw-edge or teeth-top trajectory and soil quantity grabbed up are derived by analyzing experimental data of the excavation by dredging grab-buckets.

0669 JACKSON, W. H. and NORMAN, D. R. 1974. "A Practical Application of Dredging Research," Preprint, Sixth International Harbour Congress, Antwerp, K.V.I.V., Sec. 2, Paper 2.46.

Paper describes research savings in dredging costs at the port of Garston which is located in the Mersey estuary about 15 km. from sea. History of dredging and of dredged quantities since 1932 was studied. Concentrations and movement of silt, changes in bed level of dock and channel and quantities of spoil in dredger hoppers were all monitored.

0670 JAMES, J. G. and BROAD, B. A. 1978. "Conveying Limestone Aggregates and Colliery Spoil by Hydraulic Pipeline: Trails with a 156mm Diameter Pipe," National Technical Information Service, Transport and Road Research Laboratory, Crowthrone, England, p 29.

Report contains results of the test program to study behavior of coarse granular solids (limestone aggregates up to 50mm diameter and colliery spoil) when pumped as slurries with water through a steel pipe of 156mm diameter. Headloss was measured for materials with a variety of gradings over a range of velocities up to a maximum of about 6m/s with a range of concentrations up to a maximum of 28 percent by volume (about 50 percent by weight). The results are presented largely in graphical form and a brief discussion of possible applications is given in Appendix.

0671 JAMES, W. P. 1976. "Use of Remote Sensing in Evaluating Turbidity Plumes," Proceedings, Eighth Dredging Seminar, Center for Dredging Studies, Texas A&M University, College Station, Tex.

Paper discusses use of 35 mm airphotos to quantitatively evaluate turbidity levels and measure water current velocities. Most dredging takes place under continually varying conditions. Interpretation of individual point measurements of water quality parameters become more of a problem under these varying conditions. Aerial photography offers a method to obtain an overview of the operation. An aerial photograph provides a record of a portion of the earth's surface from an elevated vantage point with a spatial resolution many times that of the unaided human eye. It is not limited to determination of size and position of objects as in normal photogrammetry but it can also be used as an energy sensor. These techniques have been shown to be effective tools in the study of dispersion of wastes from ocean outfalls and remote measurement of turbidity.

0672 JANSEN, H. J. 1979 (Jun). "Dredger Doubles as Oil Recovery Vessel," Ocean Industry, Vol 14, No. 6, pp 83-84.

Design details and method of operation of the IHC Slicktrail for 2 specialized roles-oil recovery in disasters and maintenance dredging at other times-are discussed. Vessel utilizes method of oil-sweeping arms and can clear <=15,000 tons of oil within 3 days of a spill. Principal dimensions include overall length, 118 m; breadth, 18.7 m; depth, 9 m; laden draft, 7.85 m; hopper capacity, 5,375 m^3; speed, 13 kn; and crew, 38.

0673 JESSUP, G. R. 1972 (Sep). "Concepts in Dredge Automation," World Dredging & Marine Construction, Vol 8, No. 10, pp 24-27.

Possibilities of eliminating problems by using automatic control in areas of dredging depth adjustments and pump loading control are discussed. Methods of application of auto-cut control and integrated direct digital control are described.

0674 JOANKNECHT, L. W. F. and LOBANOV, V. A. 1980. "Linear Cutting Tests in Clay," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 315-332.

Effects of blade angle, cutting angle and velocity on the cutting process were investigated. Tests indicated that the cutting process is a result of two sub-processes: actual cutting: clay is parted by blade knife edge; and transportation process of sliced clay over the blade. First process is governed by cohesion and in the second process adhesion plays an active part. Results indicate that draft force is in linear proportion to cutting velocity (up to 1.7 m/sec as used in this program). Draft force is also in linear proportion to cutting width and appears to be proportional to the square root of cutting depth. To evaluate cutting and transportation forces, additional experiments using more refined measuring equipment are necessary.

0675 JOHANSEN, C. and BIRKELAND, O. 1980. "Expansion Plans for the Robert Bank Offshore Island Port Facilities," Proceedings, World Dredging Conference, WODCON IX, pp 3-18.

An Expansion of the Roberts Bank port facilities south of Vancouver has been considered for several years. Completion of the Environmental Assessment Review Process in 1979, with the release of review panel's recommendation to proceed with a limited expansion, was an important step towards project implementation.

Existing facility consists of a 20 hectare site at the end of a 5 km (3 mi.) causeway. Port size was constructed by dredging sandy seabed material to create an offshore island and causeway. When this expansion proceeds, up to 14 million cubic metres of sandy sea-bed material will be dredged to create additional sites and widen causeway for extra railroad trackage and access roads. The magnitude of proposed undertaking is of considerable interest to dredging industry.

0676 JOHANSON, E. E. 1976. "Predicting Dredge Material Dispersion in Open Water Dumping as a Function of the Material Physical Characteristics," Proceedings, Eighth Annual Offshore Technology Conference, Vol 7, Paper OTC 2589, pp 675-682.

Paper describes results of a series of physical modeling tests that were used to establish dispersion characteristics of dredged material from San Francisco Bay. It was demonstrated that physical modeling can produce results usable for inputs to environmental impact statements, selection of disposal sites, and to estimate short-term behavior of material. Moisture content of dumped material was found to be the most important parameter in describing its short-term behavior.

0677 JOHANSON, E. E., BOEHMER, W. R., and NEEFUS, C. D. 1975. "Examination of the Turbidity Plume Generated by a Sand Mining Hopper Dredge," Proceedings, IEEE Conference on Engineering in the Ocean Environment, IEEE and MTS, pp 607-613.

Paper presents results of a study that examined predictive models for predicting dispersion and plume formation from a dredging operation; a field measurements program to collect sufficient data on an actual sand mining operation to quantitatively describe the turbidity plume, and compares predictions made by the model to field measurements. Predictions demonstrated that agreement between the model and field data is acceptable until the time that the plume shape is incorrectly predicted. A further limitation of the model was its inability to handle a time-variable water current field. Data clearly show that, for a surface discharge of overflow water, cloud initially is dispersed throughout the water column but very quickly stabilizes into a surface layer only a few feet deep.

0678 JOHNSON, B. V., CONNOR, K., and SWAN, S. A. 1979. "Environmentally Sound Peat Harvesting Technique," Proceedings, Fortieth Annual Mining Symposium, AIME, pp 1-12.

Alternatives to the milled peat process have received investigation by the Bureau of Mines. Hypothetical single-pass peat-harvesting system would have advantages of faster startup and reclamation, and require about 5 pct of the annual land use as opposed to the milled peat process. Entire depth of peat would be harvested in one pass, and fast dewatering and reclamation techniques could be used. A single-pass system could consist of hydraulic dredge, pipeline, and dewatering station. Preliminary economic analysis estimates that fuel peat could be obtained for an onsite cost of approximately $1 per million Btu.

0679 JOHNSON, G. A. and CABLE, C. C. 1974 (May). "Dredging in the Great Lakes - Impact of Environmental Factors," Society of Naval Architects and Marine Engineers, One World Trace Center, New York.

Paper outlines changes made by the Corps of Engineers, U. S. Army, in both dredging equipment and disposal methods to provide the desired environmental quality envisioned by Congressional law authorizing contained spoil disposal facilities for the Great Lakes. Impact of these changes has tended to increase cost of providing adequate channels and harbors for navigation purposes. Paper reviews past dredging practices: results of a pilot program conducted 1966-1969. Intended to develop the

most practicable methods for management of pollution problems related to dredging operations on the lakes; and equipment changes required to meet new dredging requirements.

0680 KAPTEIN, J. A. J. 1979. "A New Dredging Tool for Alluvial Mining in Swell Environment," Proceedings, International Seminar on Offshore Mineral Resources, pp 297-304.

Generated forces by wave action on floating constructions excavating the seabottom are such that waves only a few feet high might be destructive to the ladder system. Instead of compensating the movements of the ladder this design for a semisubmersible cutter suction dredger, the 'Steven 80,' avoids unwanted movements by jacking up the whole ship and fixing the center of rotation of the ladder. A case study is presented.

0681 KASTELIC, W. R. 1978 (May). "Ground Preparation for Alaskan Gold Mining Ventures," World Dredging and Marine Construction, Vol 14, No. 5, pp 26-31.

A formula for establishing the value per cubic yard of frozen material drilled and an example for correction of milligrams of gold recovered relative to actual vs theoretical core rise are presented. In order that dredging operations in Alaska continue to the maximum of what is a short season of operation (180 to 250 days a year), Alaska dredges are equipped to provide steam heat to critical areas to enable maximum cold weather operation.

0682 KAZANSKIJ, I. B. 1979. "Critical Velocity of Depositions for Fine Slurries - New Results," Proceedings, Hydrotransport 6, BHRA, Vol 1, pp 43-56.

Recent results both of the development of an objective measuring method and analysis of published data are presented. New empirical expression for predicting critical velocity as a function of weight concentration is included. Influence of coarsest particles with Froude No. of particles $Fr_x > 0.4$ is considered. Experimental basis is: coal, sand, tailings, ores, ash-slag, etc., with a pipe diameter range between 98 and 800 mm, and a specific gravity of solids between 1385 and 5250 kg/m^3.

0683 KENNEDY, M. J. 1980 (Jan). "The Hong Kong Mass Transit Immersed Tube - Some Aspects of Construction," Hong Kong Engineer, Vol 8, No. 1, pp 9-22.

Project involved construction of a twin tube tunnel 1400 m long from Tsimshatsui across the harbor to Wanchai on the Island. Survey methods used for dredging are outlined. Dredging (involving removal of 530,000 m^3 of material) was carried out in a series of straights, trench width at the invert having a 1 m tolerance either side of the screed width (14 m). Initial dredging was conducted to -19.0 m by bucket dredgers, and grab dredgers of capacity 2.5 m^3 to 14 m^3 were used both for continuation of initial dredging, and for final dredging (to -20.0 m).

0684 KERISEL, T. 1968. "Ideas of the French Administration as Dredger-Owner and Manager of Dredging Works About the Development of the Dredging Industry," Proceedings, World Dredging Conference, WODCON II, pp 25-36.

Operation of French ports, maintenance dredging volume, new works, and plans to increase dredging fleet to meet navigational demands are described.

0685 KHARIN, A. 1966. Working Soil Utilizing Suction Dredge Apparatus, Moscow.

Author sets forth methods for determining optimum performance rate of suction dredge machinery. Questions concerned with theory and calculation of the soil absorption process (by suction dredge) are examined. Mechanical components and hydraulic hoes on suction dredgers are described. An experiment was conducted using new kinds of ground absorption equipment - hydraulic and vibrating cutters - which was successful in working marshy clay-like soil and sandstone mixtures. Laboratory and production research on different soil suction equipment is described including methods and means for improving the equipment and applying it rationally. Author describes a production test which employed a special stone-crusher on the dredge's absorption pipes allowing dredge to work the gravel with a greater amount of drag.

0686 KONDO, M. and KIOWA, T. 1973. "Research on Rock Breaking by Microwave," Proceedings, World Dredging Conference, WODCON V, pp 251-285.

Article summarizes methods of rock excavation and states that rock fracture by electro-magnetic energy is very promising. This is especially true in areas where explosives can't be used due to environmental considerations. Experiments to observe penetration depth, temperature distribution, and thermal stress on mortar and granite due to microwave energy are described. No conclusions are given; however, future experiments are proposed.

0687 KONIJN, N. G. 1973. Into Reverse for Progress, an Environment Appeal by a Dredgeman, Assen, The Netherlands, van Gorcum & Comp.

Contents: Chain-type scraper; Edge-cutter and rotary cutter; Ditch clearing machine; Floating cranes; Floating bulldozer; Dredging; Dredger; Suction dredgers with or without cutters; Transport of spoil; What can a dredgeman do and how; Land reclamation; etc.

0688 KRENKEL, P. A. 1976. "Proceedings of the Specialty Conference on Dredging and Its Environmental Effects, 1976," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE.

Emphasis of the Conference was placed on evaluating current state-of-knowledge and disseminating knowledge generated by various research activities. Papers cover a wide range of subjects, including

legislation and regulations that affect dredging operations, dredges and dredging projects, dredge spoil disposal, environmental costs, water pollution aspects, land disposal and dredged fills, ecological aspects, sediment transport, and others. Volume also includes subject and author indexes, and a list of conference attendees. Individual papers are indexed separately.

0689 KRIZEK, R. J. and GIGER, M. W. 1974. "Storage Capacity of Diked Containment Areas for Polluted Dredgings," Proceedings, World Dredging Conference, WODCON VI, pp 353-364.

Guidelines are provided to enable engineers and planners charged with development of long-term confined disposal areas and the scheduling of dredging operations to estimate the required storage capacity and time-dependent nature of changes that occur as densification of the spoil takes place. One containment area in the Great Lakes was studied in considerable detail during 1972, 1973, and 1974; topographic surveys of the site were made before any dredgings were deposited and after the site was virtually filled, and an accurate total volume of the deposited dredgings was calculated. At the same time records were maintained on all dredgings being pumped into this site, and an appropriate conversion factor is established. Since density of landfills constructed in this manner changes as the dredgings dry out, density measurements were made on undisturbed samples taken from four similar disposal areas that have been in operation for as long as ten years, and these determinations are used to anticipate the increased storage capacity that becomes available as dredgings desiccate and consolidate. Based on approximate densities of compacted dredgings, advantages and disadvantages of dewatering and compacting dredgings are evaluated in terms of increased storage capacity for a given containment area and improved usefulness of the associated fill.

0690 KRIZEK, R. J. and SALEM, A. M. 1977 (Mar). "Time-Dependent Development of Strength in Dredgings," Proceedings, Journal Geotechnical Engineering, ASCE, Vol 103, pp 169-184.

Environmental or economic considerations, or both, often dictate that maintenance dredgings be placed within diked containment areas to form landfills of limited quality. Documented in this investigation is a 4-yr history of development of shear strength with time at four typical landfill disposal sites near Toledo, Ohio. Methods of shear strength determination include field vane, laboratory vane, fall cone, and unconfined compression tests; laboratory tests were conducted on continuous samples obtained by means of a specially developed manually operated piston sampler, and comparisons are made with results of the field tests.

0691 KRIZEK, R. J., GIGER, M. W., and HUMMEL, P. L. "Effect of Organic Content on Engineering Characteristics of Dredging," Department pf Civil Engineering, The Technological Institute, Northwestern University, Evanston, Ill., and University of Hawaii, Honolulu, Hawaii.

Typical polluted maintenance dredgings from five areas around the Great Lakes are investigated to determine amount of organic matter present and effect of this organic matter on several engineering properties, such as compressibility, permeability, strength, and density; in addition, the results of supporting mineralogical and chemical analyses, as well as gradation and limit tests, are reported. Various testing procedures are used to make organic content determinations, and results are found to be highly dependent on the type of test and suitability of a particular test for a given material. Liquid limit, plastic limit, and plasticity index generally increase with increasing values of organic content, but there is considerable scatter in data. Although ranges of values are given for engineering properties, it is virtually impossible to associte variations in these properties with variations in organic content.

0692 LAIRD, A. H. 1970 (Mar). "Modern Dredging Practice Using Centrifugal Pumps," South African Mechanical Engineering, Vol 20, No. 3, pp 127-131.

Paper introduces main types of centrifugal pump dredgers at present in use, their limitations and applications. Accepted empirical rules for sizing and designing a centrifugal pump dredging installation are detailed. Centrifugal pump dredging can be carried out either by a special dredging pump or standard centrifugal pump circulating water through a jet or ejector, and some special features in design of each type are discussed.

0693 LANGDON, K. J. ET AL. 1976 (Nov). "Contract Dredging - Theory and Practice," Dock and Harbour Authority, Vol 57, pp 241-244.

Report of a half day symposium, discussing contract dredging and the attitude of the client and contractor.

0694 LATIMER, J. P. 1979 (Dec). "A Steerable Ocean Floor Dredge Vehicle," British Patent No. 2022172 A.

Dredging vehicle is of the towed variety, or may be partially self-propelled. Vehicle is towed from a surface ship via a rigid length of pipe, connected to the vehicle via a pivoting joint permitting pivotal movement. In operation, pulling one cable, or pushing on one piston, causes vehicle to be skewed in a first angular direction relative to the towing pipe; pulling or pushing, respectively, in the opposite direction causes vehicle to be skewed about in an opposite angular direction relative to the towing pipe, thereby permitting at least a limited movement of the vehicle along the ocean floor in directions transverse to the towing pipe.

0695 LAUFER, K. 1972 (Jul). "Experimental Investigations of the Processes at the Cutting Head of a Suction Dredge During the Loosening of Soil," Baumasch Bautech, Vol 19, No. 7, pp 269-272.

Plant and measuring equipment as well as problems occurring during execution of experiments are described. In German.

0696 LAYCOCK, E. and STAPLETON, R. S. 1978 (Mar). "Ocean Dumping Surveillance System Developed," World Dredging and Marine Construction, Vol 14, No. 3, pp 23-25.

Under the Marine Protection, Research and Sanctuaries Act of 1972, U. S. Coast Guard is charged with conducting surveillance of ocean dumping activities. Coast Guard's Office of Research and Development has developed an electronic Ocean Dumping Surveillance System (ODSS). The ODSS will be required on all vessels engaged in ocean dumping activities. System uses Loran-C to determine vessel's position, a real time clock and various other internally generated data which will aid both

personnel on dumping vessel and Coast Guard during data processing. All required data is to be recorded on digital cassette tape on board the dumping vessel. Coast Guard will collect recorded data tapes and with computer analysis, determine who performed the dumping, which and when dumping occurred, and, in selected cases, rate of discharge.

0697 LEE, J. O. T. 1980. "Project Planning and Present and Future Construction Conditions in Developing Countries," Proceedings, Third International Symposium on Dredging Technology, BHRA, Paper X2, pp 437-446.

Paper is based on the personal experience and observations of the last 25 years in two types of developing countries, as a consulting engineer in ocean and coastal projects. Countries are not named for obvious reasons but are divided into: (i) developing countries who need and receive foreign aid; and (ii) countries who are rich enough to support development programs from their own resources. Paper starts with a brief discussion of the present situation with regard to dredging and marine contracts, aid projects and the reception that various expertise in the dredging field can expect in such countries. Errors and faults in the present conditions are then discussed with suggestions for correction. Emphasis is placed on training need and education of all types of technicians and engineers in the developing countries to understand and maintain the types of complex engineering technology that are available to them today. Role of the dredging and marine construction contractor is discussed in some detail in relation to changes that are taking place in world requirements.

0698 LE LANN, F. and ULRICH, J. 1979. "The Vibrocoring Technique and Continental Shelf Survey: The B.R.G.M.'s Experience," Proceedings, International Seminar on Offshore Mineral Resources, pp 217-232.

The Marine Geology Department of the French state body B.R.G.M. has developed a very light vibrocorer which can take undisturbed samples for measurement of the physical, mineralogical and mechanical characteristics of sediments. The vibrocoring device is of great importance for the preparation and realization of numerous offshore operations; survey of submerged pipeline and harbor channel sites; establishment of marine construction (piers, basins, break-waters); preliminary studies for dredging work; research for marine aggregates; and offshore heavy mineral deposits.

0699 LIVECKA, E. and MELZER, L. 1964. "River Dredging," Praha 1964 Statni Nakladatelstvi Technicke Literatury Slovenskie Vydavatelstvo Technickej Literatury.

Book examines underwater hydromechanical apparatus of different dredges. Chapters on: water monitoring including operating principles of monitoring equipment; mechanical cutters - their construction, function and characteristics including hydraulic principles underlying their use; evaluation of the use of hydromechanical dredges including ecological implications.

0700 LONG, E. G., JR. 1967 (Nov). "Improvement of Coastal Inlets by Sidecast Dredging," Proceedings, Journal of Waterways and Harbors Division, ASCE, Vol 93, No. WW4, pp 185-199.

Primary uses of a sidecasting dredge are given with emphasis on channel stabilization. Specifications and history of the shallow draft sidecasting dredge "Merritt" are outlined. Summary of operations and performance evaluation for a 2 year period is detailed. Operational cost information is included. Majority of work described was maintenance of tidal inlet channels in North Carolina.

0701 LOUGHY, T. 1978 (Oct). "Boomtime in the Dredging Industry," Work Boat, Vol 35, No. 10, pp 61-65, 96-98.

A variety of dredging projects and uses for dredged material is presented. Development at Harbor Island near Corpus Christi, Texas, is cited. Another example given is Taichung Harbor, Taiwan, a 10-yr project. European nations have many port development projects involving large scale dredging. Expansion and reclamation of the port at Ghent, Belgium, deepening channels around Maasvlakte at Rotterdam's Europort; enlarging the port at Marseille, France; and dredging Le Havre/Antifer to accommodate vessels of 550,000 dwt are some of the projects mentioned. A historical look at dredges is presented along with some new concepts in dredges.

0702 LOWRY, R. W. 1973 (Oct). "Dredge Pipeline Design Formula Shown," World Dredging and Marine Construction, Vol 9, No. 12, pp 36-37.

Method of G. M. Allen for predetermining how a dredge pump with pipeline and boosters can be designed is illustrated with an example.

0703 LUX, K. 1975. "Marine Bucket-Ladder Dredger," Seewirtsch, Vol 7, No. 2, pp 99-108.

Eighteen months after conclusion on the contract, bucket-ladder dredger "Georgy Nalivayko" developed and manufactured by VEB Peene-Werft Wolgast was delivered to the Soviet customer A/V Sudoimport in Moscow. She is the first ship of a series of eight dredgers of the same type.

0704 MACLEOD, N. R. and BUTLER, J. H. 1979. "The Evaluation of Dredging Materials for Island Construction in the Beaufort Sea," Proceedings, Eleventh Annual Offshore Technology Conference, Vol 4, Paper OTC 3633, pp 2387-2397.

In the summer of 1978, construction was initiated on an artificial island drilling platform, in the Beaufort Sea, in 20 m of water. Success of the project was contingent upon locating sufficient granular borrow material within 800 m of the island center. The island, named 'Issungnak,' is constructed of hydraulic fill placed by the suction dredger the 'Beaver Mackenzie.' The borrow exploration program discussed in this paper was conducted in three stages. The first stage consisted of a reflection seismic survey that quickly identified the prime borrow area. In the second stage, 19 boreholes were drilled to a maximum depth of 52 m to evaluate the nature and lateral variability of the sediments. The third stage consisted of a series of dredging tests in the proposed borrow area to establish that the necessary production rates could be achieved.

0705 MAQUET, J. F. 1980. "Construction of the Port of Le Havre-Antifer; 30 Million Cubic Meters Dredged," Proceedings, Third International Symposium on Dredging Technology, BHRA, pp 217-238.

The oil tanker port of Le Havre-Antifer was inaugurated on June 25, 1976. Dredging was carried out by means of a suction dredger with a capacity of 9,000 m^3. Dredging was disturbed by the presence of several erratic blocks, many of which were granite. A solution was formulated in which a reinforcing trawler thread raised the blocks before the dredger began to operate. Problems of accurate soundings in large open sea areas are also dealt with.

0706 MARCUCCI, I. and PAZ CASTILLO, E. 1976 (Sep). "Sidecasting the Orinoco River," World Dredging and Marine Construction, Vol 12, No. 10, pp 16-22.

Analysis of dredging efficiency of sidecasting in the Orinoco River, Venezuela, is given. Efficiencies proved to be different for the river stretch vs estuarine stretch in which considerable recirculation occurred, leading to low efficiencies. A different dredging method, e.g. hopper dredging, should be considered for this case.

0707 MARCUS, H. S. ET AL. 1977 (Jun). "Federal Port Policy in the United States," Report No. DOT-TST-77-41, M.I.T. Center for Transportation Studies, Cambridge, Mass.

Traditional federal port policy in the United States has been one in which programs of federal agencies did not disturb competitive relationship among ports. Modern technology combined with other factors such as environmental regulations has disrupted this policy approach.

Federal agencies may affect port competition in three ways: (1) allocation of funds for dredging or for port facilities; (2) implementation of existing regulations as they pertain to siting and operation of terminal facilities and their vessel movements; or (3) formulation of new policies or programs which directly or indirectly affect ports. The federal government must acknowledge administrative dilemma confronting the traditional approach to federal port policy, establish a unified governmental approach to port planning and development, and take necessary steps to evaluate future competitive impacts on ports of its actions.

0708 MARGOLIN, T. V. 1970 (Aug). "Determination of the Tractive Force of a Rotoexcavator Winch of an Anchor-Pile Dredge," Hydrotechnical Construction, No. 8, pp 753-755.

Relations in homogeneous noncrumbling soils, between the tractive force of a rotoexcavator winch and resistance of the ground to movement of the cutter is discussed.

0709 MARKS, A. J. 1978. "An Evaluation of Marine Microwave Precision Systems," Report No. 70, Institute Oceanographic Science, Crossway, U. K.

Microwave position fixing systems are portable, and relatively simple to install and use. Suitable shore sites in the survey area have to be provided. Accuracy and range (slightly more than line of sight) is generally adequate for inshore precision survey work. For 'online' position fixing a moderately fast calculating or computing unit is required to convert ranges into an acceptable coordinate system, and to perform data logging and track plotting as required. UHF systems have ranges slightly longer than the equivalent microwave system, but with some deterioration beyond line of sight. By means of complex signal processing, and computer analysis of the data, an accuracy comparable with microwave systems can be achieved. The low and medium frequency systems are generally multi-user hyperbolic systems. Low and medium frequency shore stations are less portable, and more expensive to install and maintain than UHF or microwave stations.

0710 MARSHALL, A. G. 1974 (Mar). "Position System Aids Dredging," World Dredging and Marine Construction, Vol 10, No. 4, pp 34-37.

Importance of highly accurate positional information systems on board dredges cannot be minimized. Knowing exactly where the dredge is at all times lessens possibility of overdredging and reduces wear and tear on machinery. Several positioning systems are described, and reasons for their unacceptability for dredging work are given. Author then describes a microwave direct ranging system with an accuracy of plus or minus one meter. Elements that compose system are briefly described, with reasons given for their selection and mode of operation, and capabilities that can be added to original system are also stated.

0711 MARTINEZ CATENA, M. and VIGUERAS GONZALES, M. 1969. "Latest Developments in the Design and Operation of Dredging Equipment, in Particular as Regards Suction Dredging in Very Deep Water," Twenty Second International Navigation Congress, Sec. II, Sub. 2, Paris, France, pp 27-41.

Paper explains solution adopted in Spain to solve problem of small harbors, with shallow depths and needing a reduced volume of dredging, which has been made possible by the fact that all of them are under the same Harbor Authority. Paper also deals with behavior and improvement of ordinary dredging equipment and its use under certain special conditions.

0712 MASUDA, Y. and FUKADA, H. 1971. "Method for the Continuously Dredging of Granular Sediment on the Seabottom," Report No. 7005713, Octrooraad Nederland, The Hague.

Continuous line bucket system described is not only able to dredge minerals from the deep ocean bottom but also sediments from shallow waters.

0713 MASUDA, K., MIYAZAKI, S., and OKAYAMA, Y. 1976 (Dec). "Influence of Impeller's Shape on the Characteristic of Dredging Pump," Report of the Port and Harbour Research Institute, Vol 15, No. 4, pp 95-142.

Paper deals with influence of the number of impeller vanes and their shape on performance of dredging pump in case of water only and soil-water mixture. These characteristics can be expressed by three parameters; rate of decrease of total head, rate of increase of shaft horse power and rate of decrease of efficiency. Furthermore, numerical analysis using finite difference method is carried out for potential flow of water in the space between two vanes of impeller, while photographical analysis of solid particles in them are also conducted.

0714 MAURIELLO, L. J. and DENNING, R. A. 1968. "Assessing and Controlling Hydraulic Dredge Performance," Proceedings, World Dredging Conference, WODCON II, pp 486-506.

Definition of mechanical and hydraulic dredges, production measurement and hydraulic control, characteristics of materials and their effect on production, production analysis and cost control are all dealt with. Instrumentation developments, reluctance to use, need for debugging, preference for magnetic flow meter over other instruments on basis of comparison tests are also considered.

0715 MAZA-ALVAREZ, J. A. and SANCHEZ-BRIBIESCA, J. L. 1975. "Hydraulic Studies for the Intake and Outlet Works of the Rosarito Thermoelectric Plant and the Operation of a New Type of Stationary Dredge," Proceedings, First International Symposium on Dredging Technology, BHRA, Cranfield, Bedford, U. K.

Description is given of the hydraulic models and tests carried out to study erosion and sand deposit resulting from the construction of the intake works of the thermoelectric power plant at Rosarito, Baja, California. Studies showed that the only way to prevent closing of the entrances of the intake works was to dredge. In the movable bed model, effects of dredging produced by a Sauerman type dredge was installed. This equipment had advantages such as being able to operate under conditions of any type of wave action. Two of the three pipelines of the Schoonmaker stationary dredge were placed on the site indicated by the model and the other was placed inside the intake channel. After several changes and alterations to make its operation more efficient, dredge has operated satisfactorily making it possible to keep the entrance open, as had been found in the experimental study. Operating principle of the stationary dredge is described briefly.

0716 MCCARTHY, E. P. 1976 (Nov). "Flotation Ring for Dredge Pipe Lines," U. S. Patent No. 3992735.

A hollow, flexible, two-sided, substantially C-shaped open ring which, when deflated, can readily be distorted for easy application in surrounding relation with respect to a length of dredge pipe, including strap means for temporarily securing the ring in place, and which when subsequently inflated, assumes a substantially circular cross-sectional shape and constricts radially to securely embrace the peripheral wall of the pipe for use in flotation is described.

0717 MCDONALD, R. M. 1977 (Apr). "Development of the Ship Channel Between Montreal and Deep Sea," Marine Technology, Vol 14, No. 2, pp 192-197.

Dredged channel of the St. Lawrence River between Montreal and Ile aux Coudres forms part of one of the largest inland navigation systems in the world. From the Gulf, ship can travel almost 2000 miles to the head of the Lakes. Various stages of development of the channel to obtain a controlling depth of 35 ft between Montreal and Quebec City and a sufficient depth for a draft of 48 ft - with aid of the tide - from Quebec City eastward are discussed in paper.

0718 MCLAUGHLIN, R. T., JR. 1959. "Settling Properties of Suspensions," Proceedings, Journal, Hydraulics Division, ASCE, Vol 85, No. 2311, pp 9-41.

Paper contains results of an analytical and experimental investigation of the settling properties of suspensions of particles in fluid. Use of these properties in predicting sedimentation of the particles is outlined.

0719 MCNOWN, J. G. and MALAIKA, J. 1950. "Effects of Particle Shape on Settling Velocity at Low Reynolds Numbers," Transactions, American Geophysical Union, Vol 31, No. 1, pp 74-82.

Extensive theoretical and experimental studies have been conducted at the Iowa Institute of Hydraulic Research in an investigation of effect of shape on settling velocity of particles. A number of representative axisymmetric shapes were used in the experiments, Reynolds numbers of particle motion ranging from 10^{-4} to 10^{+1}. Stability of orientation was also investigated. Analytical results were obtained for motion of ellipsoids within the Stokes range by solving Oberbeck's integral equation. Ratio of the principal-axis lengths was found to be by far the most significant of the various shape factors which have been proposed. In fact, settling velocities of particles over a wide range of shape can be estimated within ten percent from the theoretical results for ellipsoids.

0720 MCWHORTER, J. C. and ALLEN, J. B. 1976 (Jul). "Transportation of Solids by Water in Pipelines," Dept. of Agricultural and Biological Engineering Office of Water Research and Technology, Washington, D. C.

Purpose of study was to review literature and prepare a statement on current knowledge of the transport of solids by water in pipelines, and also to make a qualitative laboratory study of the behavior of solids in a stream of water within a recirculating pipeline system. Initial phase was a review of current literature. In laboratory phase, all observations were made in a horizontal test section of 4 in. diameter clear acrylic pipe. Wooden spheres and cubes with a volume of 0.212 cubic inches were observed photographically and visually. Observations were also made of polyethylene pellets approximately 0.13 in. in diameter and 0.20 in. long. Average water velocity ranged from 2.7 to 10.9 fps. Report includes summary statements regarding interaction of the carrier fluid and particles conveyed by the fluid. Laboratory findings are compatible with conclusions derived from literature review.

0721 MELTON, B. K. and FRANCO, J. J. 1979. "Shoaling in Harbor Entrances; Hydraulic Model Investigation," Technical Report HL-79-5, U. S. Army Waterways Experiment Station, CE, Vicksburg, Miss.

Report covers the results of a general investigation to determine and demonstrate some of the principles involved in harbor entrance shoaling and some of the factors to be considered in the development of solutions to the problems. Model used was not a reproduction of a reach of any stream but was designed to fit in an existing facility and provide for two bends and a straight reach between the bends. Model was of the movable-bed type with scales established arbitrarily as 1:400 horizontally and 1:100 vertically. Tests were conducted with the harbor entrance located along the concave bank of the upper bend, in the straight reach, and along the convex bank of the lower bend simultaneously. Results of this investigation are given.

0722 MELZER, L. 1968. "Czech Floating Dredgers and Their Utilization," Proceedings, World Dredging Conference, WODCON II, pp 771-799.

Description of Czech shipyard, dredges built in that country by model, size dimensions, mechanization, centralization of operation, and automation are summarized in paper.

0723 METZNER, A. B. 1954 (Jan). "Pipeline Design for Non-Newtonian Fluids," Chemical Engineering Progress, Vol 50, No. 1, pp 27-34.

A new and general method is presented for predicting the pipeline pressure-drop requirements for laminar flow of non-Newtonian fluids. Method may be used for predicting from laboratory data alone the effect of changes in operating variables such as flow rate, temperature, and solids content of the fluid and diameter of the pipe line. When no data are available, method may be used as a basis for the design of a model on which a single determination will provide the desired information about the full-scale prototype.

Method is shown to be applicable to all fluids except those whose rheological characteristics change with time (thixotropic or rheopectic) and dilatant slurries, on which no data were available. For Newtonian fluids, method reduces to the usual Poiseuille equation. The generality and utility of this method are shown by correlation of data on five plastic and pseudoplastic fluids in pipes ranging in diameter from 1/2 to 3 in.; average linear velocities of the fluids studied varied from 0.27 to 7.0 ft/sec and apparent Reynolds numbers varied from 0.43 to 1910. Fluid properties were determined with three different viscometers.

0724 MICHEL, J. F. 1967. "Offshore Dredging for Beach Nourishment - Challenge of the Future," Proceedings, World Dredging Conference, WODCON I, pp 423-434.

Offshore dredging for beach nourishment with conventional equipment fails economically. Some possible solutions lie in: bottom crawling vehicles, submersibles, semi-submersibles, spud supported towers and improved floating platforms.

0725 MILLER, R. H. 1968. "The Hydro-Dump Barge," Proceedings, World Dredging Conference, WODCON II, pp 291-314.

History, operation principles, operational comparisons for 3000 yd^3 hinged type bottom dump barges, design advantages, hydraulic operation system, and maintenance costs are all covered in paper.

0726 MILNE, P. H. 1979 (Oct). "Combined Hydrographic and Underwater Position-Fixing Systems," Dock and Harbour Authority, Vol 60, No. 707, pp 192-194.

Article discusses modern developments in position-fixing of ships and submersibles using combined surface and underwater acoustic position-fixing systems. Author describes results from research program to develop such a system for underwater inspection, maintenance and repair.

0727 __________. 1979 (Oct). "Offshore Engineering Surveys," Dock and Harbour Authority, Vol 60, No. 707, pp 194-195.

Author summarizes his reference book on underwater surveying systems with particular application to coastal and offshore structures. Numerous offshore radio position-fixing systems and underwater navigation systems available, and their inherent accuracy and correlation for precise survey work are discussed. The variety of sophisticated hardware for sea bed surveying includes depth sounders, side scan sonars, pingers, boomers, sparkers and magnetometers. Planning and preparation of hydrographic and sea bed surveying programs are considered in conjunction with modern developments in automated surveying and data processing.

0728 MOON, F. B. 1969. "Dredging Activities of the Galveston District of U. S. Army Engineers," Report No. 103-CDS, Proceedings, First Dredging Seminar, Texas A&M University, College Station, Texas, pp 22-33.

Author highlights the Corps of Engineers' policies and procedures on dredging, utilizing both private industry and government plants. He also summarizes extent of navigation works under jurisdiction of the Galveston District. Other contents: dredging workload, typical contract dredges, contract advertising and related to this: government estimates, emergency operation, hire-of-plant contract, and small business set aside. Hopper dredges are also described.

0729 MORGERA, S. D. 1976 (Nov). "Signal Processing for Precise Ocean Mapping," Journal of Oceanic Engineering, IEEE, Vol OE-1, No. 2, pp 49-57.

A bottom return signal model and accompanying signal processor are described for a wide swath bottom mapping system. An incoherent scattering model is employed under assumptions that bottom is a random rough surface composed of a large number of independent scatters with spatial correlation distance negligible relative to the ensonified area. Computer simulation results are presented and the signal processor performance examined in a qualitative fashion. Wide swath bottom mapping techniques present an attractive means of obtaining bathymetric data over large areas of ocean bottom. Precision contour maps provided by such a system are useful for area surveying as well as underwater search and exploration.

0730 MORRIS, J. W. 1975 (Dec). "Our Troubled Waterways," Water Spectrum, Vol 6, No. 4, pp 1-10.

The requirement to dredge navigable waterways to insure proper channel depths for shipping, and the resultant need to dispose of the dredged materials, has become a problem of great national significance. Unless ways can be found to continue the maintenance of waterways in the face of environmental, legal and technical constraints, a situation may be precipitated which could adversely affect the entire economy. Three problems are discussed which have arisen almost simultaneously, and which have seriously affected the ability of the U. S. Army Corps of Engineers to maintain navigation. These are: dredged material and its placement,

Environmental Impact Statement requirements and the moratorium placed by Congress on any additions, modifications or replacements to the Corps owned dredge fleet.

0731 MORRISON, J. 1970 (May). "Model Testing in Netherlands Indicate Optimum Conditions for Trenching in Submarine Pipelaying," Oil and Gas Journal, Vol 68, No. 18, pp 146-148.

A series of experimental studies and model tests conducted by the Mineral Technological Institute showed that the optimum trenching depth for each run could be obtained at very high towing speed; that a 36 in. dia pipe could be buried to a depth of 39 in. in a single run at a towing speed of 0.5 knots; that a specially designed jetting machine, making a number of successive runs, could embed a pipeline to a depth equal to twice its diameter; that with inadequately designed jetting machines, maximum towing speed is reduced by sharp increases in the forces opposing towing; and that the trench progressively assumes unsuitable dimensions (i.e., it becomes narrower than the diameter of the pipe being buried). Design and operation of the trenching machine used in the tests are discussed in some detail.

0732 MURPHY, H. D. and HERBICH, J. B. 1970. "Suction Dredging Literature Survey," Report No. I04-CDS, Texas Engineering Experiment Station, Texas A&M University, College Station, Tex.

Report is a brief review and summary of selected literature pertaining to equipment and methods associated with dredging practice and laboratory studies of dredge pumps. It consists of four parts.

1. Summary or discussion section.
2. Selected abstracts.
3. Annotated bibliography.
4. Bibliography.

Discussion section consists of two parts. Part one discusses dredging equipment and dredging in general. Part two discusses dredge pumps.

0733 MURRAY, D. A. 1976 (Mar). "A Light-Weight Corer for Sampling Soft Subaqueous Deposits," Limnology and Oceanography, Vol 21, No. 2, pp 341-344.

Light-weight piston corer to obtain sedimentary cores up to 2 metres long from soft subaqueous deposits is described. This corer, which may be used in any depth of water, uses cord rubber as the driving force to propel a core tube into sediments.

0734 NARATOOM, B. V. 1976. "Centrifugal Pump for Processing Liquids Containing Abrasive Constituents, More Particularly, a Sand Pump or a Waste-Water Pump," British Patent No. 1439666.

A centrifugal pump for liquids containing abrasives, more especially a sand pump or a waste water pump, includes means devised to eject the heavier abrasive particles from the front and rear wearing ring clearances in order to minimize abrasive wear in these regions. An annular chamber formed in one cylindrical surface of the impeller wearing ring labyrinth or annulus communicates directly with a circle of radial ducts extending fully through the annular neck portion of the impeller and its equivalent at the rear side; where each duct joins the annular chamber a blade-like ridge is formed. Liquid flowing back into the wearing ring slot entrance, under the influence of pressure at the impeller discharge, is subjected to high-speed rotation by virtue of these 'blades' and impurities are discharged radially through the ducts by a centrifugal action - before such abrasive particles have travelled any appreciable distance through the seal clearances. A modified form of the invention is also embraced by the specification.

0735 NARD, M. G. 1974 (Aug). "Syledis System Provides Accurate Dredge Positioning," World Dredging and Marine Construction, Vol 10, No. 9, pp 26-28.

The SYLEDIS electronic positioning system described uses the principle of an onboard interrogator working in conjunction with two or three shore beacons. Its accuracy is better than 1 meter within line of sight. Its range is from two to four times the line of sight. For working along a coastline, it is possible to establish an array of eight beacons and work from the first to the last with high accuracy.

0736 NASNER, H. 1976. "Regeneration of Tidal Dunes After Dredging," Proceedings, World Dredging Conference, WODCON VII, pp 799-819.

In many rivers and estuaries with sandy bed material, the movement of sediment frequently occurs in the form of sand waves. Thus, tidal dunes in the navigation channels of the Weser and Elbe Rivers are of special significance as ship draft is limited because of the crest of these sand waves. Results of investigations of tidal dunes in the field are given. Of special interest is the problem of regeneration of these sand waves after dredging. Investigation results divulge interesting aspects on the question of regeneration of tidal dunes after dredging.

0737 NAUMANN, K. E. 1974. "Dredging in the Elbe River," Proceedings, World Dredging Conference, WODCON V, pp 1-9.

Article describes history of Hamburg as a port, water depths of river to meet shipping needs, cargoes entering the port, lack of deepwater ports in Germany, and plans for development of deepwater ports in Germany.

0738 NEWITT, D. M., RICHARDSON, J. F., and GLIDDON, B. J. 1967 (Apr). "Hydraulic Conveying of Solids in Vertical Pipes," Transactions, Institution of Chemical Engineers, No. 39, pp 93-100.

Data are presented for the vertical transport of a range of materials of varying density and size distribution, the other variables being pipe diameter, slurry concentration, and velocity. Results are shown to be satisfactorily correlated by a given equation.

0739 NEWITT, D. M., RICHARDSON, J. F., and TURTLE, R. B. 1955. "Hydraulic Conveying of Solids in Horizontal Pipes," Transactions, Institution of Chemical Engineers, Vol 33, pp 93-100.

Theoretical equations are derived to express head loss along a pipe in terms of mean velocity of flow, concentration size and density of solids, and pipe diameter for various types of flow encountered in hydraulic conveying. Experiments with a variety of materials in a 1 in. pipe are described, and the data obtained are correlated by theoretical equations. These equations are compared with existing empirical correlations. Results are also presented for mixtures of sands of two distinct sizes. Conclusions of practical and theoretical significance are drawn, which enable a unified picture of the transport phenomena to be presented.

0740 NEWMAN, D. E. 1974. "Beach Restored by Artificial Renourishment," Proceedings, 14th Coastal Engineering Conference, ASCE, Vol 2, pp 1389-1398.

Paper describes how a once popular beach became denuded by the abstraction of sand for industry and how, in more recent times, it was restored to its former levels. The area history has been studied in some detail, and it can be seen that the lowering of the beach caused progressive damage to the sea wall, eventually leading to flooding of some parts of the frontage.

In the 1960's a parapet was added to certain sections of the sea wall, and local flooding was alleviated, but the lower parts of the wall and apron suffered continuously from wave attack and the situation deteriorated to an extent where complete reconstruction of the sea defenses had to be considered. It was shown that a scheme involving beach renourishment by pumping of sand from offshore provided a more economical solution and the area now enjoys amenities provided by the restored beach.

0741 NICOLETTI, M. V. 1970. "The Copacabana Beach Reclamation Project," Proceedings, World Dredging Conference, WODCON III, pp 65-106.

Paper shows the technical backgrounds that led Authorities of Rio de Janeiro State to adopt the project of the reclamation of this most impressive Brazilian beach.

It describes reclamation work executed by two cutter suction dredgers which had their land pipes installed over 4.5 km of a crowded and busy area of the city of Rio.

0742 NILSSON, G. and MICKELSON, P. I. 1980. "Rubber Liners for Dredge Pumps," Proceedings, Third International Symposium on Dredging Technology, BHRA, Paper C3, pp 115-128.

New method of reinforcing rubber makes it possible to use rubber wear parts in dredge pumps and to improve the lining economy compared to steel. This method and test results from rubber-lined dredge pumps installed on dredgers working on the west coast of the U. S. A. are described.

0743 NISHI, K. 1970. "Suction Booster Pump of Pumping Dredger," Proceedings, World Dredging Conference, WODCON III, pp 331-347.

When dredging depths reach 20 to 30 meters, the losses on the suction side of the dredge pump can become great enough to cause cavitation, making dredging impossible. Article describes the addition of an axial flow booster pump to the suction ladder to increase capacity and reduce cavitation occurrences. Dredging efficiency was reported to be 30% higher with the booster pump in place.

0744 NITTROUER, C. A. and STERNBERG, R. W. 1975 (Mar). "The Fate of a Fine-Grained Dredge Spoils Deposit in a Tidal Channel of Puget Sound, Washington," Journal, Sedimentary Petrology, Vol 45, No. 1, pp 160-170.

Fifteen thousand cubic meters of fine-grained sediment dredged from Olympia Harbor, Washington, were disposed at Dana Passage, a large tidal channel in Puget Sound, Washington. Water depth at the disposal site is 30 m; maximum tidal currents range from 110 cm/sec at the surface to 50 cm/sec at the bottom (measured 100 cm above bed). Gravity coring, bottom photography, and diver measurements allowed delineation of the dimensions and nature of the spoils deposit. Results of study are described.

0745 OEDJOE, D., and BUCHANAN, R. H. 1966. "The Pressure Drop in the Hydraulic Lifting of Dense Slurries of Large Solids with Wide Size Distribution," Transactions, Institution of Chemical Engineers, Vol 44, pp T364-T370.

Pressure drop equations developed by Newitt and other previous workers in the field of hydraulic lifting were found to apply fairly closely to dense slurries of large solids with wide size distributions when the free-settling velocity of the weight-average particle size is employed. These equations, which have theoretical validity in the case of constant-sized particles at low solid-liquid ratios and high liquid velocities where free-settling prevails, consider pressure drop as being due to three components--weights of solid and water in the pipe and water friction at the wall.

As the difference between the actual weight of solids in the pipe and that which would exist if there were no slippage equals the frictional loss between the solids and liquid, these equations only omit frictional losses produced when solids collide with each other and the wall. The fact that calculated values are as much as ten percent below experimental values at the highest solids concentrations is believed to be due largely to these neglected losses.

0746 OFUJI, I. and KOYO, J. 1974. "Effect of Ejector System on Cutterhead Suction Dredger," Proceedings, World Dredging Conference, WODCON VI, pp 507-530.

Testing of an ejector in the suction line of a dredge met calculation criteria, and increased production by 30% in fine sand. Full scale testing on dredge "Sanei Maru No. 18" are detailed.

0747 OGAWA, T., SATO, Y., and SEKIDO, T. 1971 (Sep). "IHI Engineering Review," IHI Engineering Review, Vol 4, No. 2, pp 89-99.

Dredge consists of one hopper of 4,000 cu m, two drag-arms and two dredge pumps, and can dredge at the speed of 3.5 knots against a tidal current of 2 knots. One of her unique features is the high pressure jet water system which supplies jet water from two jet pumps to the drag heads for purposes of effective cutting, agitating and dredging closely crammed sand. Equipment is automatically and/or concentrically remote-controlled, and the dredger is equipped with special measuring instrument, such as isotope mud content meter, electro-magnetic flowmeter, dredge mud meter, hopper load meter, and precision profiling sonar set.

0748 OLIVER, G. and SHRIMPTON, T. 1978 (Feb). "Computer Simulation of Port Maintenance Dredging," Dock & Harbour Authority, Vol 58, No. 687, pp 404-406.

Dredging costs form a large part of the total maintenance costs of many ports. In recent years considerable attention has been given to reducing costs of port maintenance dredging. As part of its function of promoting research on behalf of the British port industry, the National Ports Council has developed a computer simulation of port maintenance dredging and has used this simulation to study various alternative ways of meeting the national maintenance dredging committment. Article gives an outline description of the simulation and what it can do.

0749 OOSTERBAAN, N. 1974. "An Introductory Bibliography on Dredging and the Environment," Terra et Aqua, No. 7, pp 13-24.

Bibliography deals not only with problems concerning dredges and the environment but also pollution aspects, cleaning methods, dispersion, economy, legislation, monitoring, etc.

0750 OSBORNE, D. G. 1976 (Mar). "Marine Mining - the Problems of Ore Treatment," Mining and Quarry, Vol 5, No. 3, pp 16-24.

Author discusses future development of mining technology. Basic types of marine deposits and methods of recovery, including mechanical repetitive, mechanical continuous and hydraulic means are described. On board processing equipment is also considered, including the type of jigs used when upgrading cassiterite. A recent development in screening machinery, the IHC submerged vibrating screen, is briefly discussed.

0751 OTTMANN, F. and LAHUEC, G. 1976. "Dredging and Geology," Terra et Aqua, Vol 11, pp 26-34.

Understanding the geology of a dredge site is shown to be extremely cost effective. Choice of equipment, output rates, disposal procedures, and economic consequences all depend on a thorough knowledge of the area's geology. Article describes what features to look for and how to find them.

0752 PARKER, C. E. ET AL. 1977. "Identification of Alternative Power Sources for Dredged Material Processing Operations," Technical Report D-77-32, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Report provides a basis for selecting alternative, renewable power sources specifically for operating dredged material processing systems. A dredged material processing system is designed to: (1) extract sand and gravel for commercial use, (2) remove silt and clay from water to meet quality restrictions on return water, and (3) dewater residual silt and clay to reduce volume and provide a usable foundation for later land use. Currently, processing of dredged material usually consists of holding the hydraulically pumped slurry in a diked containment area and pumping or draining off the water after settlement of the suspended material. Subsequent natural drying by sun and wind presents a problem if material is fine-grained silt or clay. The scope of the assigned task was to provide a screening and selection procedure for the engineer designing a dredged material processing system in order to decide which natural form of energy (or combination), if any, should be chosen to power the system. Alternative power can be provided in several forms. The following were considered: (1) Wind power, driving pumps and electric generators, (2) Solar radiation converted to thermal and electrical energy, and (3) Hydraulic power (waves and currents) for driving electric generators. Some consideration was given to obtaining power from solid waste (such as incineration of trash), but was discarded. Of all alternative power sources studied, wind electric generation seems to be the most practical and versatile to apply at this time.

0753 PARSONS, M. A. G. and DOWSE, B. E. W. 1977 (Nov). "A Vane Test Probe Primarily for Underwater Use," British Patent No. 1492325.

Invention is intended for remote measurement of shear strengths of underwater sediment. It is intended for use in conjunction with a drill pipe lining tube. Using a system of hydraulic pistons and cylinders the device enables a core of sediment taken from below the surface of the water body floor to be subjected to a rotational torque. The maximum torque measured before the sediment shears is used as an indication of shear strength, this being transmitted to the surface by electric cables. The extent of probe penetration can be estimated by measuring the amount of hydraulic fluid returned to the surface via hydraulic lines after penetration.

0754 PASTOORS, W. C. B. 1972 (Mar). "Ocean Mining Operations," World Dredging and Marine Construction, Vol 8, No. 4, pp 23-29.

Article compares various methods of dredging, especially bucket dredging and suction dredging for use in deep ocean areas. Article then discusses application of dredging plants to offshore mining and gives guidelines for dredge selection.

0755 PASTOORS, W. C. B. 1975 (Oct). "Pipeline Trenching in Rock," World Dredging and Marine Construction, Vol 11, No. 11, pp 18-23.

Author reviews various methods available for trenching through rock, discusses handling of metamorphic rocks with specially designed cutter suction and bucket dredges and concludes that when it concerns the removal of fragmented rock, the grab or clamshell dredge and multiple-bucket dredge or ladder-dredge are the most economical and suitable types.

0756 PESKIN, R. L. 1959. Some Effects of Particle - Particle - Fluid Interaction in Two-Phase Flow Systems, Ph. D. Dissertation, Princeton University.

Intensity of motion and diffusivity of a single particle suspended in a turbulent fluid is discussed. The statistical behavior of particle motion is considered for the case of an isolated particle and for the case in which other similar particles present in the fluid exert pressure forces on the particle.

Relationship between the motion of particles in a turbulent fluid and Brownian motion is considered, and general expressions for velocity correlation and mean square displacement which are valid for both transient and steady-state situations are obtained.

0757 PETERSON, S. A. 1976. "Hydraulic Dredging as a Lake Restoration Technique: Past and Future," Toxic Substances 2nd Experts Meeting, Vol 76, No. 32.

Hydraulic dredging in freshwater lakes has caused much environmental concern. The lack of factual data from past dredging projects hinders evaluation of ecological impacts involved in future dredging efforts. Federal funds will be available through the clean lakes program for new lake restoration dredging projects, the evaluation of which should illuminate many of the environmental concerns associated with dredging. Past experiences with lake restoration by hydraulic dredging in Florida, South Dakota, and Michigan are reviewed. A proposed dredging restoration project in Lake Lansing, Mich., is evaluated.

0758 PIKE, D. 1980 (Jan). "Dredging Wheels," Dock and Harbour Authority, Vol 60, No. 710, pp 304-305.

Disadvantages of the crown wheel cutter include sideways and lifting reactions of the wheel, which are proving to be limiting factors in the design of new and larger dredgers and which have prompted designers to develop new forms of the wheel based on the bucket. The IHC dredging wheel has changed the bucket concept into a curved cutting edge; the bottom has been removed from the bucket so that material can pass through, and closely spaced overlapping cutting edges create in effect a tunnel through which spoil is passed toward the suction pipe. The disc bottom cutterhead, developed by Breebot BV, uses a similar principle in that a series of cutters are placed around the periphery of a wheel, but the blades are positioned between two discs and the cutterhead is mounted on an articulated arm.

0759 PIKE, D. 1980 (Feb). "Dredger Transport," Dock and Harbour Authority, Vol 60, No. 711, pp 336-337.

The transport of cutter suction dredgers forms the main problem since trailing suction hopper dredgers are self-propelled and bucket dredgers, once delivered, are usually employed in maintenance dredging. Installation of propulsion systems appears to be confined to larger cutter suction dredgers; heavy lift powered pontoon craft are in use for the transport of unpowered dredgers.

0760 PITA, F. and SODERQUIST, E. 1979. "Southeast Harbor Fill Project, Seattle, Washington," Coastal Structures '79, ASCE, Vol 1, pp 470-487.

The Port of Seattle is increasing its container handling and storage area by constructing a 71.5-acre development in the southeast harbor area of the Seattle waterfront. The development includes construction of a 6-million-ton fill consisting of granular fill and dredge materials. The project geotechnical investigation included drilling from piers, deepwater borings, and cone penetrometer probes. Fill materials were placed by bottom-dump barges, clamshell dredges, loaders, and off-road dump trucks.

0761 POLGAR, A. 1974 (Dec). "Major Dredging Projects Proposed for Los Angeles," World Dredging and Marine Construction, Vol 10, No. 14, pp 61-63.

Proposals for the construction of an LNG terminal with a land fill obtained by dredging a channel are described. Proposed disposal areas will be tested in a hydraulic model.

0762 POLONCSIK, S. ET AL. 1972 (Dec). "In-Place Measurement of Shoal Density," Journal, Water Pollution Control Federation, Vol 44, No. 12, pp 2334-2341.

A two-probe instrument that utilizes γ-ray penetration was modified to monitor the density of shoal deposits at depths up to 30 ft. The instrument is sensitive to its surroundings. With careful calibration and use the instrument will permit measurement of shoal densities to within ±10 percent.

0763 PORTER, W. J. and BELL, D. L. 1975. "Development of Quantitative Remote Acoustic Indices for Location and Mapping of Sea Floor Spoil Deposits," Proceedings, 7th Annual Offshore Technology Conference, Vol 2, Paper OTC 2288, pp 411-418.

The thickness and areal extent of an offshore spoil dump have been determined using recently developed remote acoustic sensing techniques. Computer processing of multi-channel reflection acoustic data acquired during traverses over dump site exhibits characteristic compressional wave velocity (C_1) and normal incidence reflection coefficient (R) which were employed to identify and map the sea floor position of the dredge spoil. Although substantially corroborating the results of

a previous spoil inventory program conducted by the University of Rhode Island, several areas outside the delineated perimeter of spoil deposition were identified. Occurrence of spoil at these latter locations was subsequently verified by physical sampling.

0764 POWER, G. 1979 (Oct). "Gravel Pit Conversion Helps Tame the Trent," New Civil Engineer, No. 367, pp 24-25.

The Trent River, which in dry periods consists of 85% effluent, is to be diverted through a series of seven purification lakes, the first and largest of which is at present being developed from a gravel pit. This lake is expected to take out about 70% of the suspended solids; a suction dredger will be used for at least eight hours each day to lift sediment from the bottom to sludge concentration tanks.

0765 PUVOGEL, K. 1968. "Design, Function and Aspects of Control Engineering of Hydrostatic Axial Piston Units," Proceedings, World Dredging Conference, WODCON II, pp 812-850.

Paper defines use of shipboard hydraulics and the advantages of an axial piston drive including its driving gear, lubrication system, production techniques, construction sizes circuit systems, controls and regulators.

0766 QUINLAN, A. L. 1971. "A View on Canadian Dredging," <u>Proceedings, World Dredging Conference, WODCON IV,</u> pp 19-27.

Statistics on land area, population, coastline, Great Lakes system, extent of drilling and blasting, lack of automation, and hidden costs of on job research are given. Rights to operate controlled by environmentalists, unions, government and socialistic politicians are also discussed.

0767 RATHBURN, D. R. ET AL. 1973. "Hydrotransport 2: International Conference on the Hydraulic Transport of Solids in Pipes, Proceedings, 1972," Proceedings, 2nd International Conference on the Hydraulic Transport of Solids in Pipes, BHRA.

Following is a list of titles presented: In-Plant Materials Handling Using the Marconaflo System Concept. Weather-Stable System for Ocean Mining/System Development and Economics. Some Experimental Results from a Feasibility Study of a Long Distance Pipeline to Carry Potash. Refuse Collection from Houses and Flats by Pipeline. New Patented Dredging System Operated by Compressed Air. Pressure Loss in Hydraulic Transport of Solids in Inclined Pipes. Control System for Hydraulic Transport of Solids in Pipes. Study on Pressure Losses in Sudden Contraction and Sudden Enlargement of Hydraulic Conveyors.

0768 REIGN, L. L. 1971. "Sudden Failure at the Tan Chau Project, Vietnam," Proceedings, World Dredging Conference, WODCON IV, pp 223-247.

Paper highlights a land fill dredging operation known as the Tan Chau Project conducted in South Vietnam in the Spring of 1970. No new dredging concepts or techniques were employed, however it is worthy of discussion because of the land slide failure associated with it. Site failure experiences should be brought into focus so that designers and operators can profit from them and upgrade dredging technology and construction procedures where possible.

0769 RENFROE, W. D. 1971. "A Portable Land-Based Dredge for No-Man's-Land Areas," Proceedings, World Dredging Conference, WODCON IV, pp 335-362.

Conventional forms of dredging can handle either the smaller job which can be reached by the dragline swinging from a crane, or the very large job that has available sufficient water to use a hydraulic dredge. In between these is a vast "no-man's-land" area, which is presently untouchable from a practical and economic point of view.

A new concept in dredging these areas is considered for its feasibility in removing mud, silt, vegetation and sludge, from out harbors, lakes, rivers, lagoons and ponds.

Case histories are reviewed in support of the premise that a portable, land-based dredge with certain unique features is a practical approach to dredging the "no-man's-land" areas between the dragline and the hydraulic dredge. Consideration as support equipment is also reviewed.

0770 RENNERT, P. 1975 (Jul). "Predicting Friction Headloss in Slurry Pipelines," Applied Sciences and Research Applications, National Science Foundation, Washington, D. C.

Article compares five different approaches to prediction of the loss of pressure due to friction when a slurry is flowing in a pipe. These theories, which are mainly empirical, are based upon laboratory tests in small pipes with some existing data on slurries in larger pipes. The results are not conclusive, but the Newitt approach was chosen for further investigation because it most nearly represented data for larger pipe sizes.

0771 RICHARD, M. 1969. "Latest Developments in the Design and Operation of Dredging Equipment, in Particular as Regards Suction Dredging in Very Deep Water," Twenty Second International Navigation Congress, PIANC.

Formulation of broad lines of personal views on the vital problems facing harbor engineers when dredging at ever greater depths are given.

0772 RICHARDSON, T. W. 1980. "Portable Sand Bypassing System for Small Harbors," Proceedings, World Dredging Conference, WODCON IX, pp 589-600.

Design, construction, and operation of a portable land-based sand bypassing system now in use in the Great Lakes is described and shown in photographs and figures. The self-contained system was designed and constructed by the Waterways Experiment Station (WES) for use by Corps of Engineers Districts in bypassing sand at harbors in the Great Lakes. System consists of equipment mounted on two land-based trailers, a self-propelled sand pickup unit which operates in the borrow area, and flexible hose modules which connect the pickup unit to the trailers. The main trailer, a standard low-bed semitrailer, carries two diesel-driven pump sets, an air compressor, a system control cab, a diesel generator, a diesel fuel tank, and assorted valves and controls. The smaller second trailer contains flow and density monitoring instruments. Sand pickup unit consists of a 200-mm discharge jet pump with cutting assists, a flotation buoy, and two propulsion jets. Control and monitoring of the entire system can be done by one person in the control cab. Estimated average production rate is 105 cubic meters per hour, with peak rates of 155 cubic meters per hour or more for discharge distances up to 850 meters from the pickup unit.

0773 RIDGEWAY, J. J. 1971. "Explosives as a Tool for Marine Construction," Proceedings, World Dredging Conference, WODCON IV, pp 207-222.

Limitations of present cutting methods are discussed and the need for a better method is presented. Design problems associated with explosive cutting are considered and a "cost-optimized" design is determined. Predictions are made of the role that a cost-effective cutter will play in the new world of underwater technology.

0774 RIDGEWAY, R. J. ET AL. 1970 (Apr). "Port Talbot Harbour Construction," Proceedings, Institution of Civil Engineering, Vol 45, pp 593-626.

Construction of breakwaters and ore jetty and the execution of the capital dredging of the harbor and its approach channel are described. The more unusual aspects of construction of the breakwaters are described, including systems developed for accurate control of rock placing, together with the plant and methods adopted. Article deals with the implementation of program initially by trailer suction dredgers. Protection of the dredged slopes by fascines is described, and siltation rates are referred to.

0775 ROBERTS, C. I. 1959 (Dec). "Hydraulic Transportation of Sands," Proceedings, Australian Institute of Mining and Metallurgy, No. 192, pp 1-27.

Factors leading to the necessity for some individual testwork in solving most specific hydraulic transportation problems are listed and a description is given of a method used in determining critical flow conditions. An outline is given of the basic theory of the purpose of the testwork, and a means of applying test results for varied pipeline diameter and material conditions follows. Engineering and economic factors are applied to the solution of a specific hydraulic transportation problem and the use of test results in plant practice is illustrated. Advantages of connecting pumps in series in centralized pumping stations rather than individually along the pipeline are stressed. Some notes are added on the future possibilities and economies of post pump injection of solids into high pressure pipelines.

0776 RODNEY, W. 1976. "Pioneer Dredging in the Klondike," Alaska Journal, Vol 6, No. 1, pp 50-53.

Dredging gold is described by tracing the activities of Joseph Whiteside Boyle and his pioneer dredges.

0777 ROMANOWITZ, C. M., BENNETT, H. J., and DARE, W. L. 1970. "Gold Placer Mining - Placer Evaluation and Dredge Selection," Bureau of Mines Information Circular 8462, U. S. Dept. of the Interior.

Report deals with the factors which should be considered in evaluating a placer deposit and selecting a dredging system for mineral recovery. Overall dredging feasibility and the design of dredging systems are reviewed. Excavation methods, each with its advantages and disadvantages, are compared.

Direct operating costs, both original and updated, of gold dredges with bucket capacities of 6 to 18 cubic feet are included. Costs vary with digging depth, changes in environmental conditions, and physical characteristics of the placer, all of which affect excavation rate and recovery. The costs, updated with appropriate indexes, should be used only as guidelines to evaluate potential dredging projects with similar characteristics.

0778 ROSFELDER, A. 1967. "Obtaining Located Samples from Sandy and Rocky Formations in Deep Water," Proceedings, World Dredging Conference, WODCON I, pp 487-516.

Ocean engineering relies strongly upon thorough surveys of the topography and nature of the sea bottom. A review of the available sampling methods shows that between shipborne drilling or deep-sea vehicle operations and rock-darting or dredging reconnaissances, there is a need for a new range of sampling instruments for operating in these formations. The feasibility of various methods, using direct penetration through implosive and explosive acceleration, bottom-standing rotary drills, self-penetrating subbottom corers, oscillatory-impact drilling, contact implosion and thixotropic liquefaction, are discussed. The necessity for an experimental and theoretical study of sampling mechanics in these environments, as a prerequisite for further advances, is stressed.

0779 RUIGERS, J. 1970 (May). "Milford Haven Dredging Project," Land and Water International, No. 9, pp 26-30.

Article describes improvements to make the harbor basin suitable for the largest ships now in use. The most up-to-date equipment is being used, which also involves dredging up rocky ground.

0780 RYE, J. L. 1965-66. "Hydraulic Applications in Dredging," Proceedings, Institute of Mechanical Engineers, Vol 180, Part 3L, pp 110-120.

Hydraulic power transmission has been successfully applied to most forms of dredges. Suction dredges employ hydraulics to position the suction tube, cutter dredgers have hydraulic motors fitted to the cutter drive, and bucket dredgers have hydraulic drive to the bucket chain. In addition, hydraulics is used to power winches and capstans, and to provide remote control of various valves and doors. Other common applications found in all types of vessel are hydraulic steering gear and, more recently, reversible bow propulsion gear. Advantages of hydraulic drive over comparable electric drives are numerous but operators are conservative. Greater realization of the benefits of hydraulic power transmission will result in more development and substantial economies.

0781 SALAM, M. A. 1974 (Oct). "Suez Canal Dredging Plans," World Dredging and Marine Construction, Vol 10, No. 12, pp 16-18.

In the framework of the redevelopment of the Suez Canal, started since 1967, extensive studies were carried out at the Hydraulic Research Center of the Suez Canal Authority at Ismailia, with the object to define relationships between canal cross section and the permissible wet section of the biggest ship that can cross the canal with difficulty. These studies are detailed.

0782 SARGENT, J. H. 1968. "Site Investigations for Modern Dredging Practice," Proceedings, World Dredging Conference, WODCON II, pp 314-337.

Paper is directed primarily to a consideration of the geotechnical investigation and, in particular, procedures necessary for obtaining accurate pre-tender knowledge for the analysis of the dredgeability of soils and rocks to be encountered.

0783 __________. 1971. "Feasibility Studies for Dredging Projects," Proceedings, North Sea Spectrum, NORSPEC 70, Paper I4, pp 51-56.

The present-day approach required to determine engineering feasibility of works involving dredging are outlined. The field of dredging works discussed are defined and modern dredging methods are reviewed.

0784 __________. 1972. "Dredging Equipment and Techniques," Proceedings, Marinas and Small Craft Harbors, Symposium of the University of Southampton, pp 221-237.

Aspects of the civil engineering requirement where water areas, depths or land areas may be insufficient are detailed. Review is given of the types of dredge available, factors in choosing the dredge, and some applications which have been made of dredges.

0785 SATO, E. 1976 (Nov). "Dredging Techniques Applied to Environmental Problems," World Dredging and Marine Construction, Vol 12, No. 12, pp 32-38.

Article describes suction dredging equipment used to minimize turbidity and pollution in dredging sediments containing toxic materials from the sea bottom.

0786 __________. 1977. "Application of Dredging Technique for Environmental Protection," Seatec 77: The Dredging and Construction of Ports for Developing Countries.

Author emphasizes importance of research in reducing the impact of dredging on the environment. Turbidity caused by dredging can be minimized with a correctly designed cutter suction head. Waste water may have a high silt and clay content, which is separated by settling

or by flocculation, and other methods are being sought. Special equipment is described for dredging contaminated sediments, and the wastewater treatment is also mentioned.

0787 SAUZAY, G. 1975. "Appraisal of Radio-Active Tracer Techniques in Dredging Operations."

Dredging cost can be minimized by reducing the distance to the dumping site. A balance must be established between cost of transport and eventual return of spoils to the deepened areas. Cost of transport is known but efficiency of the dumping site is much more difficult to establish. Article reviews how radio-active tracer techniques can be used to follow the actual movement of sediments and give information about transport parameters in practice.

0788 SAXENA, P. C., VAIDYARAMAN, B. P., and BRAHME, S. B. 1975 (Sep). "First International Symposium on Dredging Technology," Proceedings, First International Symposium on Dredging Technology, BHRA, Canterbury, Kent, U. K., pp D4-47 - D4-57.

India, having a coastline of about 5700 km and over 225 ports of different sizes, is faced with numerous problems relating to dredging and spoil disposal. The problems on the eastern and western coasts are markedly different from one another. Paper deals with the experiences gained from the different ports in India and highlights considerations leading to the choice of disposal sites in different cases deperding on the physical condition together with the role of hydraulic model studies in such instances.

0789 SCHMIDT, F. J. 1971. "The Dustpan Dredge - an American Development and Its Future Possibilities," Proceedings, World Dredging Conference, WODCON IV, pp 49-91.

Paper covers description of dustpan dredge, operating procedures, advantages of design, history, and use in North America.

0790 SCHNETLER, F. 1968. "DECCA Activities in Coastal and Offshore Work," Proceedings, World Dredging Conference, WODCON II, pp 255-290.

Use of electronic positioning equipment to prevent work delays from fog mist and poor visibility is described. Three station fixing, application to dredging operations, use of decca equipment during construction of Europort, data logging equipment, and the need for fast moving vessels for hydrographic survey work are all covered.

0791 SCHOENBERG, G. 1974. "Rotary Dredge Cranes on Pontoon," Proceedings, World Dredging Conference, WODCON V, pp 287-310.

Discourse provided on general needs for operation of floating grab cranes mounted on a pontoon. Equipment and power needs are discussed along with types and capacities. Considerations are also given to "onward transport" of dredge material.

0792 SCHWARTZ, R. K. and MUSIALOWSKI, F. R. 1977. "Nearshore Disposal: Onshore Sediment Transport," Proceedings, Coastal Sediments '77, Fifth Symposium of the Waterway, Port, Coastal and Ocean Division, ASCE, pp 85-101.

New dredge disposal techniques may serve the dual role of aiding: (i) sand bypassing across coastal inlets, and (ii) beach nourishment provided that dredged sediments placed seaward of the surf zone move shoreward into that zone. During the summer of 1976, 26,750 m^3 of relatively coarse sediment was dredged from New River Inlet, N. C., moved downcoast using a split hull barge, and placed in a 215 m coastal reach between the 2 m and 4 m depth contours. Bathymetric changes on disposal piles and in the adjacent beach/nearshore area were studied for a thirteen week period to determine the modification of surrounding beach/nearshore profile and the net transport direction of the disposal sediment.

0793 SCHWEITZER, K. F. 1978. "A Suction Head for the Suction Pipe of a Suction Dredger," British Patent No. 1499015, Jan 1978.

A suction head fitted with cutter and crushing tools is described. The crushers are operated by hydraulic piston cylinders mounted on the suction pipe. The crushers are designed to cut material, free material from the suction pipe inlet should it become blocked, crush such material and thus feed it to the suction pipe. An important aim of the design is to avoid disadvantageous load torques that are normally associated with conventional rotary cutterheads.

0794 SEARLES, D. 1980 (Mar-Apr). "Hydraulic Dredge Saves Space and Time," Industrial Wastes, Vol 26, No. 2.

The Waterless Dredging Company of Mattoon, Illinois, designed a floating hydraulic dredge specifically for mining of industrial and municipal wastewater sludges. Dredge can remove materials from depths to 16 ft and adds just 0-10% by vol of water to the material. The higher percentage of solids removed means a reduction in sludge transportation costs, a decrease in acreage needed for spoil areas, and a reduction in dredging costs and time. The waterless dredge is presently at work removing sludge from a series of 8 water treatment ponds. Removal rate on this job is 200 yd^3/hr.

0795 SEWELL, W. 1975 (Aug). "One Port's Solution to Financial Barriers," World Dredging and Marine Construction, Vol 11, No. 9, pp 16-19.

Description is given of practical dredging problems encountered when dredging a harbor expansion in Galveston. Use is made of cutter suction dredges for dredging hard clay containing shells and sand.

0796 SHIMUZU, T. 1977 (Mar). "Semi Submersible Dredging," British Patent No. 1463191.

Patent describes a semi-submersible dredging method intended to solve problems associated with the mining of heavy materials in sandy type deposits on the continental shelves or metallic nodules on the deep sea floors. A semi-submersible shell is used, the inside of which is kept at atmospheric pressure. Material is sucked in from outside the shell as a result of flow in the intake pipe caused by the difference in pressure between the inside of the shell and the outside. The water is subsequently separated from the solids. The latter is deposited in a reservoir before being transported to the surface by ladder buckets.

0797 SHORT, J. E., KUYPERS, J. C., and ROBERTS, P. O. 1977. "Federal Port Policy in the United States," Technical Report No.: DOT/TST-77/41, Massachusetts Institute of Technology Cambridge Center, Cambridge, Mass.

The traditional Federal port policy in the United States has been one in which programs of federal agencies did not disturb the competitive relationship among ports. Modern technology combined with other factors such as environmental regulations has disrupted this policy approach. Federal agencies may affect port competition in three ways: (1) Allocation of funds for dredging or for port facilities; (2) implementation of existing regulations as they pertain to the siting and operation of terminal facilities and their vessel movements; or (3) formulation of new policies or programs which directly or indirectly affect ports. The Federal government must acknowledge the administrative dilemma confronting the traditional approach to Federal port policy, establish a unified governmental approach to port planning and development, and take the necessary steps to evaluate future competitive impacts on ports of its actions.

0798 SILIN, N. A. ET AL. 1969. "Research of the Solid-Liquid Flows with High Consistence," Thirteenth Congress, IAHR, Vol 2, pp 1-10.

Paper presents the most important results of the turbulent characteristics investigations of solid-liquid flows: the distribution of the averaged longitudinal velocities and the consistences in flow section, velocity oscillations of the solid-liquid components as well as the correlation momenta. A method of the pressure drops calculation due to friction is proposed which is effective under the conditions of different in size sandy materials hydrotransportation.

For the same conditions the relationship for determining the velocity which corresponds to the beginning of sedimentation/critical velocity is given.

0799 SLOTTA, L. S. 1968. "Flow Visualization Techniques Used in Dredge Cutterhead Evaluation," Proceedings, World Dredging Conference, WODCON II, pp 56-77.

Paper briefly describes flow visualization movie studies of dredge cutterhead models. Discharge performance tests were run with synthetic granular material for quantitative evaluation of model

cutterhead modifications. Similitude criteria for dredge models are discussed and an experiment is described which represents a first step in establishing dynamic similarity for the movement of dredged material into the suction inlet of the cutterhead.

0800 SLOTTA, L. S. "Model Tests of Material Flow Through Dredge Cutters and Suction Piping," American Society of Mechanical Engineers, Paper 69-MH-19.

Hydraulic flow conditions near and within a rotating cutterhead of a suction dredge were studied by scale models and flow visualization techniques. Suggestions for improved inlet conditions are made. Cutterhead wear tests gave meaningful wear indications.

0801 SLOTTA, L. S., JOANKNECHT, L. W. F. and EMRICH, R. 1977 (Dec). "Evaluation of Dredge Cutterhead Production as Affected by Cutter Height," World Dredging and Marine Construction, Vol 13, No. 13, pp 9-19.

Article gives a detailed account of model tests designed to determine the best proportions of cutterhead diameter versus height. Purpose of the studies and conclusions drawn are given. Authors discuss the test equipment and test design, the processing of signals, materials selection and evaluation, sand tests and materials preparation, consolidated media preparation, test data regarding the conglomerate, test design and basis for comparisons, tests in compacted sand and tests in conglomerate.

0802 SMALLEY, A. H. ET AL. 1974 (Jun). "Sand, Gravel Dredging Effects on Tennessee River Analyzed," World Dredging and Marine Construction, Vol 10, No. 6, pp 33-35.

At two dredging sites, dredging effects on the environment have been monitored and the conclusions are briefly summarized.

0803 SMITH, C. and MITTLEMAN, J. 1978. "Underwater Jetting and Jet/Dredge Tool for Diver Use," Technical Memo. NCSC-TM-229-78, AD-AO 58 718, Naval Coastals Systems Center, Panama City, Fla.

Underwater jetting and dredging components were tested to determine their hydrodynamic characteristics. Components were combined to form a three-way combination system of a single jet, a single dredge and a combination jet-dredge system. Operational characteristics of these three configurations were then determined by testing their ability to excavate the sandy sediments in the waters off Panama City, Florida. The single jet system rapidly fluidized the sand, but did not transport it effectively, the single dredge system transported the sand effectively but required constant attention to prevent clogging the suction. The combination jet-dredge system gave the best overall excavation rate and required less work from the diver than either single component system.

0804 SMITH, D. D. and GRAHAM, K. F. 1976. "The Effects of Institutional Constraints on Dredging Projects, San Diego Bay: a Case History," Proceedings, World Dredging Conference, WODCON VII, pp 119-141.

The jointly funded Corps of Engineers San Diego Harbor Navigation Improvement Project, originally proposed as a 12 million cubic yard, $8 to 10 million project to commence in 1972, has been delayed 3 years and the disposal plan modified extensively, largely as a result of institutional constraints. When finally approved in 1975, project volume was 8.5 million cubic yards and the contract price was $18.7 million. About $5 million of the cost increase was the result of environmentally related institutional constraints.

0805 SMITH, K. P. and ARMOUR, M. J. 1978 (Apr). "Changed Conditions in Dredging Contracts," World Dredging and Marine Construction, Vol 14, No. 4, pp 20-2[illegible].

Contractor is held contractually responsible for conditions which could have and should have been reasonably anticipated. A proper analysis must be made of the site and of subsurface exploratory data included in the contract. If a subsurface or latent physical condition is encountered which could not reasonably have been foreseen, the owner, in the common "changed condition" clause, promises that he and not the contractor will bear the economic burden of that condition. A discussion of some recent cases points out considerations which a dredging contractor should have in mind when he formulates his bid, as well as when performance problems actually arise.

0806 SMITH, L. N. 1977 (Jun). "Underwater Excavating Apparatus and Method," British Patent No. 1480266.

A dredging machine is described and the methodology for using the machine is outlined. Unit comprises a forward floatable dredging section and a rear floatable tail section connected by an intermediate hull section. The dredging section pivots in an arc relative to the tail section whilst the machine is anchored by spuds on the rear section. Once the dredging in this arc has been completed the dredging section can be moved forward by increments relative to the anchored tail section by means of an extension system.

0807 SMITH, R. A. 1955. "Experiments on the Flow of Sand-Water Slurries in Horizontal Pipes," Transactions, Institute of Chemical Engineering, Vol 33, No. 2, pp 85-92.

Experiments on the pumping of sand-water slurries through 2 in. and 3 in. bore horizontal pipes are described. Sands of several size-gradings were used at concentrations up to 27% by volume. Pressure drop was measured at velocities from 3 to 8 ft/sec and the velocity at which sand first began to settle on the bottom of the pipe was noted. The pressure drop was found to be always greater than that calculated on the assumption that slurry behaved as a homogeneous liquid of the same density.

Results are compared with a published correlation based on experiments with closely-graded materials. To apply this correlation to materials of mixed sizes it is necessary to calculate equivalent diameter as the diameter of a particle whose surface-area/volume ratio is equal to that of all particles. It is shown that the correlation can be used to predict pressure drop approximately, but for more accurate information it would be necessary to carry out a small-scale experiment on the pumping of a sample of actual slurry.

Characteristic curves of the centrifugal slurry pump used in the experiments were determined. It was found that the pump efficiency fell only slightly with increasing concentration of slurry up to 24% by volume.

0808 SOLLITT, C. K. and CRANE, S. D. 1974. "Physical Changes in Estuarine Sediments Accompanying Channel Dredging," Proceedings, Fourteenth Coastal Engineering Conference, ASCE, Vol 2, pp 1289-1303.

Physical characteristics of estuarine sediments provide useful information about sediment sources, nature of bottom surface stresses and sediment transport mechanisms. Changes in sediment composition and state are also useful indicators for estimating effects of unnatural stresses on dependent chemical and biological activities. In this study, changes in several sediment properties have been monitored for an isolated estuarine dredging project. The effect of estuarine hopper dredge activities has been evaluated for an Army Corps of Engineers project at Coos Bay, Oregon. Project included suction dredging at a shoal area within the navigation channel and in bay spoiling at a deep section of channel one mile downstream from the dredge site. Core samples were taken five days before dredging and two, thirteen and seventy days after dredging at the dredge and spoil sites. Subsequent laboratory analysis of the core samples revealed that dredging induced redistribution of bottom sediments produced significant changes in several physical characteristics of the dredged material.

0809 SORENSON, A. 1973. "Meaningful Dredge Specifications," Proceedings, World Dredging Conference, WODCON V, pp 159-183.

Paper considers poor specification writing, lack of standards and ambiguous dredge criteria. Examples are given.

0810 SORENSON, A. H. 1976. "Today's Criterion for Designing and Operating a Hydraulic Pipeline Dredge in Underwater Mining," Proceedings, Placer Exploration and Mining Short Course, Nevada University, Reno, Nev.

Author states that too few builders and operators have begun to make dredge building and dredging a true engineering discipline and he outlines some of the parameters and concepts that must be dealt with if dredge technology is to achieve the same level as other modern technologies. Author discusses the mechanical components of a hydraulic pipeline dredge and the physical factors effecting dredge mining. Operating

conditions, basic dredge laws, dredging efficiency and output are considered. The underwater dredge pump, development of the excavator (plain suction, cutter suction and bucket wheel dredges) and new trends such as training, simulation, instrumentation and automation are considered also.

0811 SOUDER, P. S. ET AL. 1978 (Jun). "Dredged Material Transport Systems for Inland Disposal and/or Productive Use Concepts," Technical Report D-78-28, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Report identifies and evaluates transportation systems applicable for the movement of dredged material inland. Report is intended to provide generalized data which can be utilized in evaluating the economic potential of inland disposal alternatives for specific applications. Considerable detail from both a technical and economic point of view is provided to allow report users to apply the information presented to their particular situations. Where a given application requires modification in a specific transportation concept and/or an alteration in specific cost elements, the level of detail should facilitate any such required changes.

0812 STANITZ, J. P. and PRIAN, V. 1951. "A Rapid Approximate Method for Determining Velocity Distribution on Impeller Blades of Centrifugal Compressors," Technical Note No. 2421, National Advisory Committee for Aeronautics.

Method of analysis was developed for both compressible and incompressible, nonviscous flow through radial- or mixed-flow centrifugal compressors with arbitrary hub and shroud contours and with arbitrary blade shape. Method is used to determine approximately the velocities everywhere along the blade surfaces, but no information concerning variation in velocity across the passage between blades is given.

Eight examples for two-dimensional flow, covering a fairly wide range of flow rate, impeller-tip speed, number of blades, and blade curvature, the velocity distribution along the blade surfaces was obtained by the approximate method of analysis and compared with velocities obtained by relaxation methods. In all cases, agreement between the approximate solutions and the relaxation solutions was satisfactory except at the impeller tip where velocities obtained by the approximate method did not, in general, become equal on both surfaces of the blade as required by the Joukowski condition.

0813 STEPHENS, H. S., COLES, N. G., and CLARK, J. A., eds. 1977. Papers Presented at the Second International Symposium on Dredging Technology, BHRA Fluid Engineering, Cranfield, U. K.

Twenty-six papers are presented covering: economic aspects, soil mechanics, channel clearance, dredge head technology, mining, trenching and jetting dredged material, disposal, spoil dewatering and texture, slurry sedimentation and erosion, and pipeline technology.

0814 STOJANOVIC, Z. 1971 (Oct). "Development of a Dredging Pump Working Model of Various Impeller Widths," World Dredging and Marine Construction, Vol 7, No. 11, pp 30-32.

A model dredge pump was used to study the pump behavior due to various impeller widths. Results give a general review of how the impeller width affects the dredge pump working characteristics. The model test results compared favorably with established methods of calculating pump characteristics.

0815 STONE, M. J. 1979 (Mar). "Geotechnical Aspects of Dredging," Dock and Harbour Authority, Vol 59, No. 700, pp 352-360.

The most common complaint of dredging contractors regarding soil investigation is that information is either insufficient, is presented in a manner that makes interpretation difficult, or is inaccurate. In the area of interpretation, nearly every soil investigation company has its own terminology, favored tests, and procedures. The major concern with inaccuracies is degree of training, reliability, and ability of the people actually carrying out the soil investigation. Often, all work is done by local unskilled temporary labor, with the exception of an expatriate engineer and a drilling foreman. While laboratory results are generally more accurate, care and handling of samples prior to being received by the laboratory could often be seriously questioned. Should timing not permit a thorough pre-tender site investigation, sufficient time should be allowed in the tender period and contractors should be actively encouraged to carry out a joint soil investigation. Much more information is needed, simply stated with a uniformity of language and testing procedures, to enable contractor to do the work in the least expensive and most efficient manner.

0816 STORM, D. R. 1975. "A Predictive Method for Assessing the Impact of Maintenance Dredging in an Estuary," Third International Ocean Development Conference, Vol V, Paper E-2007, pp 169-186.

The physical, chemical and biological processes which are altered during a typical maintenance dredging operation are analyzed. A conceptual model is used to relate various processes and to serve as a guide in preparing dynamic models for quantification for key parameters such as suspended sediment transport and deposition. Actions and processes during dredging and post-dredging period are discretely separated into dredging, spoiling and equilibration categories. A prototype estuarial system, Bolinas Boat Channel, Bolinas, California, is selected to demonstrate the predictive possibilities of the impact analysis methodology. Methodology is tested on a proposed project to dredge shoal materials from the mouth of the Bolinas Boat Channel. A hydrodynamic, numerical model is modified to accomodate a velocity-suspended sediment function for predicting disposition of disturbed substrate materials during dredging process. A separate computer run was made assuming dredging in a more hydraulically active channel of the lagoon system. Model predicted more dispersion of the sediment throughout the Lagoon than for the Boat Channel alternative.

0817 STYER, F. W., PIETERS, E. T., and HATHEWAY, D. J. 1979 (Sep). "Practical Automated Dredge Surveys," World Dredging and Marine Construction, Vol 15, No. 9, pp 29-33.

Paper describes techniques implemented to support channel dredging operations, including initial survey operations (shore control, bathymetry, condition surveys and preliminary survey), dredging survey operations and support (dredging cut layout, pre-dredging survey, dredging support, and post-dredging survey), and data reduction for volume computation (river level determinations, off-line operations, charting, cross-sections and volume computation).

0818 SUSTAR, J. F. 1976. "Implications of San Francisco Bay Studies on Regulation of Dredging," Proceedings, World Dredging Conference, WODCON VII, pp 85-101.

The San Francisco District of the Corps of Engineers is concluding a $3 million study to define impacts associated with dredging and sediment disposal on the San Francisco Bay marine environment. Criteria for managing the dredging activity have been in a state of flux with criteria having very little correlation with the marine system. Author's view of management criteria is presented based on the results of these studies.

0819 SUTHERLAND, J. and SHURGOT, M. 1975 (Jan). "Dredging in the Father of Waters," Not Man Apart-Foe, Vol 5, No. 5, pp 1-4.

The Upper Mississippi River Wildlife and Fish Refuge is a vast expanse of land and water extending 285 mi between Wabasha, Minn., and Rock Island, Ill. Greatest impact on the river's environment is caused by U. S. Army Corps of Engineers maintenance of a 9 ft barge channel. Corps dredges millions of tons of slurry from the channel every year, and deposits the spoil on islands and other bottomlands. Corps plans to deepen channel to 12 ft. The multi-sided controversy over creating a wilderness to protect the refuge is discussed, with emphasis on positions taken by a citizen's action group, the U. S. Fish and Wildlife Service and U. S. Army Corps of Engineers.

0820 SWANBOURNE, J. F. C. 1970. "The Dredging of Milford Haven," Proceedings, World Dredging Conference, WODCON III, pp 425-442.

Article describes two dredging projects in detail from initiation of the contract through completion. Both projects required removal of large amounts of rock from locations of little or no shelter in a fluctuating sea-state. Details concerning the drilling and blasting procedures and quantities removed are given. Comparisons between the effectiveness of bucket and grab dredges are given.

0821 SZAMOSI, P. 1975. "Dredging Apparatus," U. S. Patent No. 3990379, Nov 1976.

A marine dredging apparatus is described which is connected to the surface by means of a plurality of articulatedly interconnected rigid pipe sections that can be wound up on a prismatic reel that in turn is disposed on, in or around a vessel. To facilitate winding in a helical configuration, axis of the prismatic reel is disposed at an angle to the horizontal.

0822 TERRY, L. E. 1967. "It's What's Up Front that Counts," Proceedings, World Dredging Conference, WODCON I, pp 91-114.

Article emphasized that for a cutter suction dredge to be successful, the cutter must match the demands of the project. Recent advances in the fields of metallurgy, design, and fabrication of cutters are described and numerous examples are cited. Greater production and less downtime for repair and maintenance are possible with the correct selection of cutter design and materials.

0823 THIEMANN, J. and WOLF, G. 1974 (Nov). "Dredging on the River Elbe," World Dredging and Marine Construction, Vol 10, No. 13, pp 30-35.

Article discusses maintenance dredging and the conversion to hopper suction dredges, water depths and characteristic bottom formations, dredged spoil (amount and calculation), floating take-over station, and advantages of hopper dredges.

0824 TIBBY, R. B. 1967. "Considerations of Academic Programs for the Dredging Industry," Proceedings, World Dredging Conference, WODCON I, pp 593-602.

Paper briefly traces the broad historical development between the dredging industry and academic institutions and outlines the present trends in university programs related to dredging interests.

0825 TRAWLE, M. J. and HERBICH, J. B. 1980 (May). "Prediction of Shoaling Rates in Offshore Navigation Channels," COS Report No. 232, Texas A&M University, College Station, Tex.

Report discusses several techniques in use for prediction of future dredging requirements whenever enlargement of estuarine/coastal entrance channels are considered. The dredging requirements of six selected entrance channels for both existing dimensions and the immediately previous dimensions were determined to evaluate the 'volume of cut' prediction technique. The adequacy of the 'volume of cut' technique was investigated by 'predicting' dredging requirements for the existing project from previous project dredging requirements. The results, although based only on a limited number of projects, suggest that the technique can be a valuable tool during preliminary analysis of a proposed entrance channel enlargement.

0826 TRONDSEN, E. and MEAD, W. J. 1977 (Aug). "California Offshore Phosphorite Deposits - an Economic Evaluation," IMR Reference, California University Institute of Marine Resources, Davis, Calif.

Summaries of known worldwide identified reserves, production, demands, and exports are included. Chemical and mineralogical characteristics of deposits at 8 sites offshore Southern California are

evaluated for economic profitability. Capital and operating costs for 2 dredging technologies--employing a hydraulic suction dredge and an innovative jet lift dredge--are outlined. Various arrangements for transportation onshore, loading, and beneficiation are evaluated. Rates of return are calculated for various technological combinations and 2 rates of production.

0827 TURNER, T. M. 1970. "The Basic Dredge Laws," Proceedings, World Dredging Conference, WODCON III, pp 411-424.

Author explains the basic hydraulics of dredging by presenting the "Seven Basic Dredge Laws." Each law is a simple, understandable hydraulic relationship relating significant factors to dredge production. An understanding of these principles is a prerequisite to a successful dredging operation.

0828 __________. 1972. "Optimizing Dredge Operating Conditions," Proceedings, World Dredging Conference, WODCON IV, pp 687-696.

Dredge production rates are discussed along with testing facilities developed for the testing of Ellicott Machine Corporations "Solid Optimizer." Device operates on the principle of sensing the difference between entering and leaving pressures of a moving column of slurry in a discreet length of pipe.

0829 TURNER, T. and FAIRWEATHER, V. 1974 (Oct). "Dredging and the Environment: the Plus Side," Civil Engineering (New York), Vol 44, No. 10, pp 62-65.

Dredging has been unduly attacked by environmentalist groups. Advantages of newer hydraulic dredges over mechanical dredges are discussed and examples of dredging projects in which environment was repaired or otherwise environmentally improved are given. A description of the various kinds of dredging equipment is included and the problems of deposition of dredge material are also examined.

0830 UCHIBAYASHI, T. 1970. "Dredging of Hard Soil and Rock with Cutter Suction Dredge," Proceedings, World Dredging Conference, WODCON III, pp 107-117.

A cutter suction dredger has been usually used for dredging ordinary soil and sand. For dredging hard soil, a dipper dredger has been mostly used, but since about twenty years ago a suction dredger with powerful cutter has come to be used for dredging hard soil or rocks broken up by blasting or rockbreaker as well as dipper dredgers. In recent years these types of suction dredgers with powerful cutter has been used more widely than a dipper dredger, because of their high dredging efficiency.

0831 ULBRICHT, F. 1977 (Jul). "On the Improvement of the Multi-Bucket Dredge," Baumasch Bautech, Vol 24, No. 7, pp 451-456.

Author stresses that in view of the permanent request of dredge operators for optimum units, it is an urgent question whether the multi-bucket dredge can be improved or not. In spite of the technical advance, a comparison of the older with modern versions hardly shows any improvement of the essential element of this unit: the chain drive with the buckets. Report deals with the further development of this item. In German with English abstract.

0832 VAN BRAKEL, I. 1974 (Feb). "Cost/Output Ratio of a Trailing Suction Hopper Dredger," Dock and Harbour Authority, Vol 54, No. 640, pp 366-369.

Article presents mathematical method and equations for the determination of hopper capacity, sailing speed and output of a trailing suction hopper dredge.

0833 VAN COOREMAKEN, J. J. C. M. 1974. "New Developments in Integrated Processing Systems on Sand and Gravel Dredgers," Proceedings, World Dredging Conference, WODCON V, pp 369-390.

Paper covers the shipboard treatment of sand and gravel following recovery. Loading, classifying and offloading is dealt with. A "Venturi" draghead, double-walled dredgepump perfected by IHC Holland are described along with screening and sieving procedures. Hoppers, cyclones and centrifuges are also included in the discussion.

0834 VAN DEN BOOGERT, J. 1971. "The Loading of Trailing Suction Hopper Dredges," Ports and Dredging, No. 71, pp 4-10.

Detailed are a number of concepts and definitions which exist in relation to the loading of hoppers, and to show why time required to load a trailing-suction hopper dredger varies in practice. Factors such as specific gravity of sand, overflow losses, influence of soil type on loading time and how this can be predicted are also discussed. Anticipated hopper load and the factors governing this are discussed.

0835 VAN DER VEEN, R. 1980. "Maintaining the Depth in Silting Ports by Silt Pumping Stations," Proceedings, World Dredging Conference, WODCON IX, pp 607-608.

Maintenance dredging of ports is a recurrent problem, in particular when the port is in open connection to a source of silt.

Because the navigable water within the port has to be calm, silt settles there and has to be removed from time to time to maintain the port depth. Distinct from usual methods of removing silt, i.e. bucket-dredges with barges and trailing suction hopper dredgers, a silt pumping station may be an attractive alternative.

Object of such a system is to pump new-incoming silt on the instant back to the source in order to stabilize the port depth. Advantages are savings in power consumption and costs. Furthermore it lends itself to automation.

From research into patent applications, a historical review of the idea is given and criteria for applicability are mentioned.

0836 VAN DIJK, H. 1968. "The Execution of Dredging for the Construction of the 'Metrotunnel' Under the River Nieuwe Maas in Rotterdam," Proceedings, World Dredging Conference, WODCON II, pp 972-996.

Paper describes special aspects of dredging work that was necessary for building the Rotterdam underground. Contents: Air bubble screen to keep at least the area in the vicinity of the piles free from silt; removal of silt deposits by suction methods; sand filling, displacement of a tunnel section as a result of a flow slide; repairs of damage; and measures to increase stability of the filling sand around the tunnel.

0837 VAN DIXHOORN, J. and DE KONING, J. 1969. "Latest Developments in the Design and Operation of Dredging Equipment, in Particular as Regards Suction Dredging in Very Deep Water," Twenty Second International Navigation Congress, PIANC, Sec. II, pp 87-113.

Contents: I. Purpose of dredging in deep and very deep water in The Netherlands; 1) Cuts for channels and harbor basins, 2) Winning of sand and gravel, II. Types of deep digging dredgers used and analyses of the dredging cycle; 1) Stationary deep suction dredgers, 2) Deep dredging trailing hopper dredger, III. Practical applications; 1) Winning of sand from a great depth with suction dredgers with a submerged pump, 2) Deep dredging with trailing hopper dredgers.

0838 VAN HATTUM EN BLANKEVOORT, B. V. 1975 (Jul). "A Method and Arrangement for the Hydraulic Conveyance of Dredged Materials," British Patent No. 1400316.

Floating pipelines are used for conveying dredged material from a moving suction dredger to a stationary point which may be waterborne and anchored. Invention lies in holding the pipeline under tension such that collapse of the pipeline is prevented but there is no excessive loading on the end attachment points. Pipeline ends are preferably wound on tensioned reels whose shaft may be horizontal or vertical.

0839 VAN HOUWENINGE, G. 1980. "Execution of a Soil Improvement in the Oosterschelde," Proceedings, World Dredging Conference, WODCON IX, pp 827-840.

In 1976 it was decided to build a storm surge barrier in the Oosterschelde whilst execution of the original plan for closing off estuary was already in progress.

This meant that before starting the first part of the foundation, that is a soil improvement, already placed bottom protection had to be removed. After removing bottom protection a trench was to be dredged in the axis of the barrier in a waterdepth of up to 40 m below M.S.L.; this is carried out by means of a specially developed dustpan dredger.

The last part of the soil improvement is the placing of fine and coarse sand in the trench which is done in two different ways; dumping through the doors of a hopper dredger or pumping back through the suction pipe of the hopper dredger.

Paper describes the removing of the bottom protection, dredging of the trench by a dustpan dredger and refilling of the trench by a hopper dredger.

0840 VAN OOSTRUM, W. H. A. 1975. "Programmed Dredging," De Ingenieur, Vol 87, No. 27, pp 545-557.

A system for programmed dredging at sea for use by self-propelled hopper suction dredgers is described. Results of investigations in the entrance channel near Hook of Holland meant to achieve optimal efficiency are discussed.

0841 VAN OOSTRUM, W. H. A. and LUBBERS, A. 1976. "Deep Dredging for Offshore Purposes. A Method to Clear Stones and Boulders from the Seafloor," Petrotech '76, European Spring Meeting of the Society of Petroleum Engineers, AIME, Paper SPE 5759.

In the case of the production platform Condeep 2, problems arose when inspection of the sea bottom showed presence of many stones and large boulders. Before platform could be placed, these obstructions had to be cleared from the sea bottom. A method of dredging with steel nets together with acoustic positioning was considered.

0842 VAN REENAN, E. D. and FURSE, L. D. 1967. "A High Resolution Profiler for Dredging and Underwater Mining Applications," Proceedings, World Dredging Conference, WODCON I, pp 471-486.

Obtaining a high resolution seismic profile of the shallow subbottom is now possible with the use of a high resolution boomer. The acoustic pulse is clear and discrete without appreciable noise and interference. Numerous examples are given which demonstrate its potential use in the dredging industry.

0843 VENNE, L. J. 1971. "Metallurgical Quality Control for Dredge Cutter Parts," Proceedings, World Dredging Conference, WODCON IV, pp 285-301.

Dredge cutters, merely by their name, imply wear and actually abrasive wear. Some parts of the dredge cutter, such as tips or points, are subject to the most abrasive wear, hence require higher hardness and more abrasion resistance steels of the cutter package.

Selection of proper materials for wear resistance can sometimes mean the difference between profit and loss in some operations. Consequently, the search for better and more economical wear resistant materials is the constant goal of many types of industry.

0844 VOCADLO, J. J. and SAGOO, M. S. 1973 (Feb). "Slurry Flow in Pipes and Pumps," Journal, Engineering for Industry, ASME, Vol 95, No. 1, pp 65-71.

New approach to slurry flow both in laminar and turbulent regimes is outlined. Emphasis is on the approach for turbulent slurry without deposits which does not rely on subdivisions of slurries into arbitrary groups and which is based on identifiable mechanisms of energy loss. Some aspects of slurry systems and pumps are discussed.

0845 VOLBEDA, J. H. and HERSHEY, J. W. 1973. "The Utility of Modern Channel Dredging in Open Ocean," Proceedings, Ninth Annual Conference of Marine Technological Society, MTS, pp 57-65.

Recent development of the trailing suction hopper dredge has been most important in producing a tool for the construction of harbors throughout the world of sufficient depth to accommodate the modern very large bulk ships. Increased hopper sizes, tolerance of high wind velocity and sea conditions, ability to dredge to 35 meters depth have resulted in costs which have shown substantial resistance to inflationary trends.

0846 WAKEMAN, T., SUSTAR, J. F., and DICKSON, W. J. 1975 (Feb). "Impacts of Three Dredge Types Compared in S. F. District," World Dredging and Marine Construction, Vol 11, No. 3, pp 9-14.

Three types of dredging systems were evaluated for short term impacts as a result of their operations. The impacts were divided into dredging associated impacts and disposal associated impacts. Cutterhead, grab, and trailing suction dredges were investigated. Results showed that grab dredges produced the highest rise in turbidity, but that the typical values were small compared to what normally occurs during high run-off periods or high wave activity.

0847 WALDECK, F. F. 1967. "The Hoffer Automatic Relief Valve System for Suction Dredges," Proceedings, World Dredging Conference, WODCON I, pp 197-206.

Paper defines use of Hoffer Automatic Relief Valve System that eliminates "slugging," "ramming" or choke off of the dredge pump when pump is operating at or near maximum capacity.

0848 WALKER, W. R. and COX, W. E. 1978 (Jun). "Administration: Law," Journal, Water Pollution Control Foundation, Vol 50, No. 6, pp 1689-1695.

Literature on the legal issues of water quality is reviewed. Much is devoted to consideration of various waste treatment requirements and programs initiated by the Federal Water Pollution Control Act of 1972. Provisions of the amendments to the Act in 1977 are summarized: Stream and Effluent Standards, Control over Dredge and Fill Operations, Control of Toxic Pollutants, Areawide Wastewater Management Planning, The Safe Drinking Water Act of 1974. Irrigated agriculture, federal common law, marine pollution and miscellaneous pollution problems are surveyed.

0849 WATANABE, R. I. 1967. "The Japanese Dredging Industry," Proceedings, World Dredging Conference, WODCON I, pp 31-38.

Increase of dredging fleet in Japan is detailed with an inventory of dredging companies and dredges by type and size.

0850 WATTS, G. M. 1971. "A Study of Ocean Bar Response to Dredging in the Throat of an Inlet," Proceedings, World Dredging Conference, WODCON IV, pp 321-334.

A closer look at many tidal inlets reveals that if a plan is considered to stabilize the inlet with entrance structures (normally entrance jetties), dredge entrance channel to desired depths, and then periodically re-dredge channel as required as well as maintain entrance structures, the projected annual benefits for the improvement will not be equal to annual costs and overall plan is not a sound or justified

investment. One of the items contributing to high first costs in such a plan involves protective entrance structures. If the desired entrance channel depths could be achieved and maintained through use of conventional pipeline dredge plant, without these entrance structures, a more favorable economical picture would, in many cases, result.

Study described involves evaluation of the response of the ocean bar and channel system from dredging of a deposition basin, located sufficiently into the inlet to provide protection during dredging operations for a conventional pipeline dredge.

0851 WATTS, G. M. 1973. "Offshore Dredging for Beach Fill Purposes," Proceedings, World Dredging Conference, WODCON V, pp 104-119.

The concept of mechanical placement of suitable sand for purposes of shore stabilization has been recognized and employed in the United States for many years. The hydraulic dredge has been utilized in most beach fill operations. However, there are a number of cases where the borrow excavation and placement operation have been accomplished by other mechanical means. The hydraulic dredge has proven particularly advantageous where distance and variation of ground elevations (lift) between the borrow site and beach placement zone are not excessive and where quantities to be transferred are relatively large within a specified time frame.

Many beach fills in semi-protected waters, utilizing offshore borrow, have been carried out in the United States. However, only a few beach fill projects have been carried out where the borrow is in completely exposed ocean waters. Objective of paper is to summarize these exposed beach fill operations including some of the environmental effects.

0852 WATTS, G. W. 1962. "Mechanical Bypassing of Littoral Drift at Inlets," Journal, Waterways and Harbors Division, ASCE, Vol 88, WW1, pp 83-99.

Brief examination of the general processes of littoral drift movement at uncontrolled and controlled coastal inlets is presented. Principal factors are noted that should be evaluated when mechanical bypassing of drift past an inlet is considered. General techniques of bypassing are examined, and the types of plants used in the operation are described. A summary is given of all completed and active bypassing projects in the United States.

0853 WEBB, P. 1979. "Legal and Economic Aspects of Dredging Marine Aggregates in the U. K.," Proceedings, International Seminar on Offshore Mineral Resources, No. 7-1979, pp 49-60.

Many mineral resources exist on the ocean floor, but only a few sites are mined, particularly marine aggregate deposits. Paper describes the history of such activities on the U. K. Continental shelf. Both legal and economic aspects are considered.

0854 WEBB, R. J. 1973 (Jan). "Maintenance Dredging: An Operations Research Approach," Terra et Aqua, No. 6, pp 1-10.

Paper describes research the Dredging Research Unit of the University of Wales Institute of Science and Technology is undertaking into modelling of dredging operations. It tackles the problems of specifying dredgers for maintenance operations and argues that this exercise should involve considerations outside normal engineering practice.

0855 WEBB, R. J. 1974. "Transient Considerations in Harbour Dredging," Sixth International Harbour Congress, Section 2, Paper 2.44.

Procedures in general use for specifying dredgers for maintenance dredging operations often assume that both demand for dredging services and the output of dredgers is constant over time. In fact, both factors are subject to marked variations and they interact to cause transient conditions. Paper sets out a rational approach to this issue and illustrates use of Monte Carlo simulation techniques in this context.

0856 __________. 1977. "Transient Considerations in Maintenance Dredging," Terra et Aqua, No. 12/13, pp 24-27.

Efficient management of port maintenance dredging requires an accurate specification of the dredging system. Due to transient conditions often encountered in dredging, a reserve capacity should be built into the dredges. A technique is given to determine the optimum reserve capacity given the port characteristics and dredging requirements.

0857 WELLING, C. G. and CRUICKSHANK, M. J. 1966. "Review of Available Hardware Needed for Undersea Mining," Marine Technical Society Meeting on Exploiting the Ocean, MTS.

In any mining system, five basic steps are involved. These are: location of the deposits, evaluation of the ore-body, ore extraction, beneficiation, and transportation. Current available hardware is reviewed with emphasis on evaluation and extraction phases. Review considers the types of deposits that will be mined under the sea. It is emphasized that no one method will fulfill the system's requirements for all mining operations. Available tools are many and varied and hardware requirements become well established as new deposits are sought and discovered. Ultimate success of future undersea mining operations depends strongly upon the selection or development of optimum equipment and systems for the particular task.

0858 WELTE, A. 1971. "Estimation of Design Data for Transportation of Solids in Horizontal Pipe Lines," Proceedings, World Dredging Conference, WODCON IV, pp 125-170.

Relationship of pipeline transportation to other mass transportation modes, characteristics of conveyed solids, density ratios, settling velocities, slip between solids and conveying fluid estimates of flow, and pressure loss are all covered.

0859 __________. 1972 (Feb). "Hydro-Jet Deep Embedment Method," World Dredging and Marine Construction, Vol 8, No. 3, pp 15-19.

The hydro-jet deep embedment method of laying cable and pipe underwater has been improved and is now capable of economically embedding cables and pipes of large diameters. The hydro-injector which is adapted to the work required and shaped accordingly is fitted with nozzles which direct water jets down and in the direction of advance. Loosened soil is thrown up while the pipe is layed in the ditch which is refilled as the soil settles. This method has the advantage of: a) No soil removal, b) simple depth control of flushed in cable or pipe, c) protection of pipes from anchors, fishing gear, and currents, d) simultaneously laying several pipes.

0860 WELTE, A. 1979 (Oct). "Dredging Technique and Its Recent Development and Applications," Baumasch Bautech, Vol 26, No. 10, pp 522-528.

Report discusses some new products and processes used for improvement of dredging technique. In German with English abstract.

0861 WESTNEAT, A. S. 1976. "Remote Classification of Marine Sediments," Proceedings, Specialty Conference on Dredging and Its Environmental Effects, ASCE, pp 289-298.

Acoustic echoes from a sub-bottom profiler are examined by computer processing for significant relationships that describe physical properties of the sediments. Certain results are offered, leading to conclusions that this technology offers a new tool for bottom studies. An acoustic wave, generated in the water column, can penetrate the seafloor and may be reflected sequentially from the interfaces between layers of differing physical properties. Echo is modified in significant ways by its passage through the soil, ways that relate to the fundamental characteristics of the sediment. By appropriately processing these echoes, by computer, estimates of important sediment properties may be obtained.

0862 WIEDENROTH, W. 1968. "An Examination of the Problems Associated with the Transportation of Sand-Water-Mixtures in Pipelines and Centrifugal Pumps," Proceedings, World Dredging Conference, WODCON II, pp 537-566.

Advancements of pipeline transportation over past 50 years are reviewed. Characteristics of transported materials (sphere diameter), transportation of sand and gravel, transportation of materials through centrifugal pumps, and the need for further backing, new tests, and theoretical work are all covered.

0863 __________. 1971 (Oct). "Transportation Problems of Sand-Water Mixtures in Pipelines and Centrifugal Pumps," World Dredging and Marine Construction, Vol 7, No. 11, pp 21-29.

In order to realize the desired high profitability of dredging installations, system conponents must be matched to each other. To match components effectively, the factors of loosening and picking up

material, transporting it, and depositing it must be understood. Author describes tests to determine behavioral characteristics of materials commonly transported in dredging operations while they are in the pipelines and also in centrifugal pumps. Tests were carried out using an assortment of different sands and gravels of carrying shapes and sizes to determine the terminal falling velocities of the materials and wearing of the particles. Conclusions from tests are given in detail. He then discusses the bahavior of materials in pipelines under different conditions of density, mixtures, and flow velocities.

0864 WIGGINS, J. H. 1975 (Oct). "Engineering Risk Control Reduces Dredge Losses," World Dredging and Marine Construction, Vol 11, No. 11, pp 34-38.

Actual dredge failures that have taken place within the last 2 years are illustrated and the hazard, problem, and outcome are mentioned along with mechanism of failure. Using these examples as three types of failures and recognizing that there are many other hazards that can be accounted for, a hypothetical decision analysis is examined. Given probabilities computed from inductive or deductive means which are associated with each occurrence, five basic methods are discussed.

0865 WILLEMS, C. E. 1975. "Dredging: Economics and Project Control," Terra et Aqua, No. 7, pp 9-12.

Dredging project management is concerned basically with the factors of risk vs economics. Risk minimization should be of the utmost importance to both the project manager and to the contractor. Article discusses how contracts can be prepared to minimize risks and improve performance for all concerned.

0866 WILLEMS, R. 1979 (Dec). "The Development of Human Resources in and by the Dredging Industry," Terra et Aqua, No. 18, pp 22-26.

Since the development and expansion of a port directly creates job opportunities, the dredging industry, although not in itself labor intensive, has a significant international role to play in job creation. Fundamental requirements for the development of the dredging industry in developed and less developed countries are presented, together with the extent of governmental involvement in dredging. It is concluded that in less developed countries the work load covered by state dredgers will probably be restricted to less complex maintenance projects. International contractors will play a vital role in advising and training personnel, and also taking the peak load of non-recurrent projects. The dredging industry is helping to expand and develop use of human resources particularly by the formation of international organizations for specialist advice and training.

0867 WILLUMS, J. O. and BRADLEY, A. 1974. "M.I.T.'s Deep Sea Mining Project," Sixth Annual Offshore Technology Conference, Vol II, Paper OTC 2138, pp 1071-1080.

Three projects are presented: The Vertical Ocean Mining System combines a hydraulic mineral recovery device with a stable surface platform. The Underwater Robot is able to conduct large area surveys of mineral deposits. Ocean Mining Site Evaluation Program is able to process data on possible mining locations in order to establish the economically best choice over a given time.

0868 WILSON, J. F., LOWREY, D. P., and MILLAN, J. D. 1976. "Dredging with Tidal-Powered Scouring Jets," Proceedings, Eight Annual Offshore Technology Conference, Vol II, Paper OTC 2585, pp 611-619.

One alternative for maintaining channels at a specified depth is to locally accelerate tidal currents with a transportable, bottom-crawling funnel whose jet aids in scouring. Several 1/30th scale model configurations were built and tested in a laboratory flume to study effects on volume yield rate (jet-scoured trench size) of the controlling system parameters. Correlated data lead to an optimum dredge-jet design.

0869 WITT, W. 1967. "Pressure Water Supplied Trailing Suction Heads," Proceedings, World Dredging Conference, WODCON I, pp 133-171.

Text describes dredging equipment developed for the "Ludwig Franzius." Previous experience and the application of systematic model experiments led to the creation of new pressure water suction heads, bringing about a doubling of the output of fine types of sands.

0870 WOLTERS, T. A. 1975 (Jul). "Suction Dredger with Swell Compensation," U. S. Patent No. 3893249.

Tension load on the cable suspending the nozzle and conduit of an earth suction dredger is reduced by employing one or more reversing sheaves at the nozzle with multiple cable passes thereover. In order to 'sling' the nozzle end pulleys or sheaves, the slinging pairs of cable portions are guided and maintained side-by-side and are acted upon in unison by the swell compensation device.

0871 WOODBURY, D. F. 1974. "Dredge Safety and Construction Standards," Proceedings, World Dredging Conference, WODCON VI, pp 325-339.

Today's dredge operator is burdened with many responsibilities. Three stand out as being of primary importance: (1) crew safety, (2) protection of owner's investment, and (3) ability of equipment to perform its task. Because all of these items are reflected in dredge construction, design and outfitting of hull, house, and superstructure prove to be basic to the operator in fulfilling his responsibilities.

0872 WORSTER, R. C. and DENNY, D. F. 1955 (May). "Hydraulic Transport of Solids in Pipes," Iron and Coal Trades Review, Vol 170.

Results of research into hydraulic transport of solids in pipes are summarized. Test results on breakage of particles and wear of metal parts are mentioned. Problems associated with high pressure required are discussed.

0873 YAGI, T., KOIWA, T., and MIYAZAKI, S. 1976. "Turbidity Caused by Dredging," World Dredging Conference, WODCON VII, pp 1079-1110.

Paper investigates causes of turbidity by suction and grab type dredges. Effects of swing speed and depth of cut are defined. Reduction of turbidity through the medium of a fully enclosed grab bucket indicates its suitability of turbidity control over open top grab buckets.

0874 YOCHUM, W. A. 1975 (May). "Clam Dredge Aids in Sand Retrieval," World Dredging and Marine Construction, Vol 11, No. 6, pp 30-32.

Author reports that the clamshell dredge described can remove oversized material and process it, making more valuable material lying below the oversized rejects readily available. Primary use of the dredge lies in the sand and gravel industry; however, it also has adaptability for navigational and harbor work.

0875 ZAHN, G. A. and SIAPNO, W. D. 1975. "Rationale for Navigation Systems for Manganese Nodule Mining," Proceedings, 1975 Conference on Engineering in the Ocean Environment and Eleventh Annual Meeting of the MTS, IEEE and MTS, p 507.

Paper discusses the requirements of navigation equipment for deep ocean mining. Presentation includes the positional accuracy desired, together with rationale for establishing these requirements. In order to develop an appreciation of the problem, the environment in which mining is to take place is described and specific equipments and related operational characteristics are identified. Paper covers test and exploration phases with some extension into commercial mining phase.

0876 ZANDI, I. and GOVATOS, G. 1967 (May). "Heterogeneous Flow of Solids in Pipelines," Journal, Hydraulics Division, HY3, ASCE, Vol 93, No. HY3, pp 145-160.

Solid conveyance through pipes is now an industrial reality. There are many installations testifying to the practicability and, in most cases, to the economic advantages of this mode of transportation. Although the early industrial solid pipeline dates back to the beginning of the twentieth century, long-distance line conveying high concentration slurries is a recent innovation. In the 1960's several excellent reviews of the state of the art and economic potential of pipeline transport have been published.

Despite the potential of solid pipeline systems as a means of transportation, the inability to predict accurately the head losses that will occur under an assumed condition has been one of the factors impeding development and widespread use of hydraulic transportation. At the present time (1967), available equations for prediction of head loss give such unreliable results that expensive pilot plant studies are necessary prior to design work.

A0149 "'Alpha Bay,' Largest Split-Hopper Trailing Suction Dredger from IHC Holland," Shipbuilding and Marine Engineering International, Vol 103, No. 1241, Sep 1980, pp 375-376.

Article describes 'Alpha Bay,' with a hopper capacity of 4,300 m^3, 112 m long and can dredge to a depth of 27 m. She was built for Costain-Blankvoort UK Dredging Co., Ltd., and is equipped with 800-mm-diameter suction pipes on both sides.

A0150 "'Alpha Bay' Splits into Service," Dredging and Port Construction, Vol 7, No. 7, Jul 1980, pp 19-20, 22.

Article describes the 'Alpha Bay,' a split-type trailing suction hopper dredger, the largest of its type in the world with a hopper capacity of 4,300 m^3 and a dredging depth of 27 m. Discharge of spoil is accomplished by splitting of the hull (divided longitudinally along its entire length and connected at deck level by huge hinges), which is operated by 4 remote controlled hydraulic cylinders. Spoil may be dumped in very shallow water by this method and it is particularly suitable for heavy, cohesive materials. Dredge is also equipped with a self-discharging system for pumping spoil ashore to a disposal area up to a distance of 2,000 m. Other principal features of the vessel are also given.

A0151 "American National Standard - Safety Requirements for Dredging," ANSI Standard, A10, 1974.

Safety standard applies to the operating, inspection, and maintenance of any vessel fitted with machinery for the purpose of removing or relocating of material from or in a body of water. Article deals with safety standards for dredging.

A0152 "An Apparatus for Burying a Pipeline Laid on the Sea Bottom," Industrieele Handelscambinatie Holland, Holland Patent ND, 1969.

An apparatus for burying a pipeline laid on the sea bottom is propelled astride the pipeline and has a suction tube to help in excavating a ditch next to and underneath the pipeline. An adjustable excavating device and an auxiliary suction pipe ahead of and above the excavating device are also described.

A0153 "A New Method for Ditching Underwater Pipelines," Erdoel und Kohle-Erdgas-Petrochemie, Vol 23, No. 2, 1970, p 119.

A new method for ditching underwater pipelines involves laying the pipeline on the sea bottom, dragging a train of skids onto the pipeline, and water-jetting the pipeline under the sea bottom by means of nozzles on the skid. A surface vessel then pulls the skid train off the buried pipeline. Accessory mechanical or hydraulic equipment can be mounted on the first skid for working on a hard sea bottom.

A0154 "An Improved Dredge Pump," Konijn Machinebouw B.V., The Netherlands, and Bagger-en Constructiebedrijf Johan Klip B V., The Netherlands.

Dredge pump was designed with the aim of reducing clogging caused by solids and vegetation. Pump has a central inlet and a lateral outlet. Passage in the impeller progressively increases in width from inlet to outlet and clogging is reduced as material is subjected to undisturbed lateral discharge from the passage under the action of centrifugal force. Front and back plate of the impeller have sharp edges which cut incoming material and create a whirling motion in the material reducing the risk of clogging.

A0155 "Another Deep Suction Dredger for De Groot Nijkerk-Holland," Holland Shipbuilding, Vol 28, No. 6, Aug 1979, p 62.

Dredger has a capacity of 250-350 m^3 per hour and is built in sections for easy transfer from one job to another. Craft is equipped with a hydraulically driven submerged sandpump, mounted on a ladder. Suction and discharge pipe diameters are 310 mm, and the maximum dredging depth is 30 m.

A0156 "Apparatus and Method for Deep Sea Dredging Includes Pendulously Mounted Conduit and Tool Controlled by Four Wire Ropes," Canadian Patent No. 960-233, Dec 1974.

Tool guiding lines extend from the vessel to the conduit via respective guides anchored at locations spaced about region to be dredged. Effective guide line lengths are adjusted from respective winches mounted on the vessel to sweep dredging tool back and forth across dredged region. Conduit is rotated about its vertical axis to operate the dredging tool.

A0157 "Artificial Island in the Sea," V.D.I. Nachr, V. 33, No. 49, Dec 1979, p 4.

Description of the artificial island recently completed at Landskrona in Sweden is given. Work began in 1977 with removal of 26,000 tons of rock, gravel and sand in preparation for the retaining wall construction.

A0158 "At Jebel Ali - a New Concept in Dredging," World Construction, Vol 32, No. 8, Aug 1979, pp 26-30.

The dredger 'Al Wassl Bay,' the world's first offshore self-elevating heavy duty cutter suction dredger, was designed primarily for work at Jebel Ali, United Arab Emirates. It is presently working on dredging a 17-km-long and 235-m-wide channel to give access to a new 74-berth harbor complex. Article describes how the new dredger works, its novel anchoring system, and economic considerations of the project.

A0159 "Automatic Swing Control System for Dredge," U. S. Patent No. 3,471,949, May 1967.

A control system for limiting the swing speed of a dredge including a variable flow control valve for varying amount of fluid supplied to the swing motors, and a sensing system responsive to the cutter head load for opening and closing the flow control valve is described.

A0160 "Bean Begins Theodore Channel Project," World Dredging and Marine Construction, Vol 15, No. 11, Nov 1979, pp 43-44.

Article reports on the construction of a new navigation channel and turning basin at Theodore Industrial Park, Alabama. Work is being carried out by the Bean Dredging Corporation using a bucket dredger-barge combination to save fuel, and also to experiment with the subsidence at the bottom of Mobile Bay. The Corporation expects to use three suction dredgers at a later stage of the project, thus eliminating some of the booster pumps required to move material through the pipeline.

A0161 "British Dock Dredge Fleet Allows 'unimpeded access,'" World Dredging and Marine Construction, Vol 12, No. 10, Sep 1976, pp 41-43.

General review is given on British Transport Docks Board's activities concerning maintenance dredging in British ports.

A0162 "Calculating Resistance in Pipelines Used for Hydraulic Transport," British Chemical Engineering, Vol 5, No. 8, Aug 1960, pp 534-536.

After a review of available methods, author concludes that an exact solution of the problem of determining pipeline resistance is not possible for all hydromixtures.

Author concludes that the effects of basic variables can largely be combined and expressed analytically in accordance with three types of hydromixtures. These groups can be defined with relative ease and thus the placing of any hydromixture into the appropriate group and choice of a suitable formula is largely a matter of classification.

A0163 "Canadian Propulsion Unit for 'Dustpan' Dredger," Dredging and Port Construction, Vol 6, No. 9, Jul 1979, pp 5-6.

Propulsion and station-holding capability on the Eagle Dredging Corporation's dustpan dredger 'Benel Bean' are provided by two Maritime series 900 Z-drives. Article also mentions two contracts currently being undertaken by the Eagle Dredging Corporation.

A0164 "COBLA Orders Split Hopper Suction Dredge," World Dredging and Marine Construction, Vol 15, No. 8, Aug 1979, p 17.

Costain-Blankevoort Dredging Group has placed an order with IHC Holland for a trailing suction hopper dredger of the IHC Splittrail type. Vessel will have a hopper capacity of 4,000 m^3 by volume and 6,000 tons by weight, making it the largest of its type to date.

A0165 "Compact Underwater Dredging Unit Designed for Use by Divers," World Dredging and Marine Construction, Vol 14, No. 10, Oct 1978, p 21.

The first production unit of a new jet pump dredging unit manufactured by Alluvial Mining, Essex, England, is being supplied to a Scottish-based offshore maintenance company. Unit is designed for use by divers in underwater clearance, maintenance, trenching, and offshore mining. System is versatile and the company anticipates a variety of underwater applications including the following: bottoming of pipeline trenches and other excavations; clearance of silt and spillage around jetties, docks, locks, and offshore oil platforms; replacement of material lost by tidal scour; and recovery of offshore minerals, particularly diamondiferous gravels where highest values occur in crevices and potholes in bedrock. Unit is currently operating in the North Sea in 600 ft of water on a pipeline maintenance contract removing silt from the trench prior to replacement of a damaged section of oil pipeline.

A0166 "Computer Controlled Navigation System," International Dredging and Port Construction, Series II, Vol 3, No. 16, Jan 1976, pp 10-11.

Article describes the Nautomat system, a steering stand which includes a digital computer. With this steering stand a ship's path is automatically controlled on a pre-selectable series of great circles.

A0167 "Concentration Measuring Instrument for Hydraulic Transportation Installations," La Houille Blanche, No. 2, May 1953, pp 296-297.

A simple device is described which allows direct measurement of slurry concentration. An adjustable contraction in a vertical pipe allows the clear water head loss to be eliminated, thus only the head loss due to the solids is measured by an ordinary differential manometer. This reading is easily converted to concentration.

A0168 "Contraction Flow Meter for Mixtures of Water and Materials," La Houille Blanche, Vol 8, No. 1, Jan-Feb 1953, pp 64-78.

In order to study fundamental characteristics of slurry flow, a series of new experimental devices have been built. Article describes a contraction flow meter designed for such special test conditions.

A0169 "Corps Hopper Dredges Converted to Single Dragtender Operation," World Dredging and Marine Construction, Vol 14, No. 10, Oct 1978, pp 13-15.

The seagoing hopper dredges Hains and Hoffman are 215 ft long with a hopper capacity of 1900 yd^3. Dredges are diesel electric with a single pump and port and starboard drags. Direct pumpout includes a 21-in. collection system, shore connection discharge outlets, and a hopper jetting system with 2 diesel-driven jetting pumps. With the installation of this system, both dredges are capable of bottom dumping or direct pumpout to shore disposal areas. Dragtender positions were identified as one area where a cost reduction could be achieved by a reduction in manpower. Optimum location for the dredge control center was on the bridge deck in the pilot house. This location provides excellent visibility of draghead davits and hopper deck and affords a direct line of communications with the mate responsible for the operation of the vessel. Design is basically an electrical control console which would consolidate required existing controls with controllers and solenoid-operated valves as required. Collection and discharge system, dredging controls, and the jetting sections are discussed.

A0170 "Corps of Engineers Orders New Shallow Draft Hopper Dredge," World Dredging and Marine Construction, Vol 15, No. 3, Mar 1979, p 19.

Hopper dredge Yaquina is scheduled to be completed in Dec 1979 and is being built by Norfolk Shipping and Drydock Corporation of Norfolk, Virginia. Some design parameters are given and special operating features are described for the dredge. Modern technological features include twin controllable pitch propellers and a diesel driven 250-hp bow thruster. There will be an automatic dragarm handling system and computers will dominate operation of the dredge.

AD-A137 958 DREDGING: AN ANNOTATED BIBLIOGRAPHY ON OPERATIONS EQUIPMENT AND PROCESSES REVISION(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS HYDRAULICS LAB MAR 82 WES/HL-82-7 4/5

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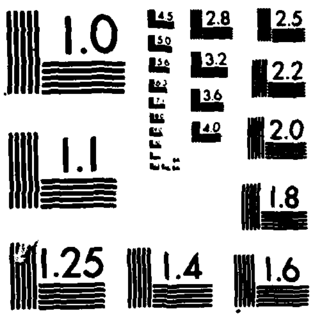

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A0171 "'De Hollandsche Ijssel', Prominent Builders of Sophisticated Dredging Materials," Holland Shipbuilding, Vol 28, No. 8, Oct 1979, pp 93-94.

Details of a 500-litre self-maneuvering bucket dredger are given. An automatically controlled swinging movement of the dredge gear on top of the pontoon will make possible the dredging of a canal 25 m wide and 3 m deep.

A0172 "'Delta Bay,' Powerful and Versatile Trailing Suction Dredger for Costain-Blankvoort," Holland Shipbuilding, Vol 20, No. 12, Feb 1972, pp 1037-1040.

The 7987 gross ton trailing suction dredger 'Delta Bay' is described. Dredge has loading capacity of 14,700 tons.

A0173 "Design Change Produced More Dredging, Lower Cost, at Ras Al Mish'Ab," World Dredging and Marine Construction, Vol 14, No. 7, Jul 1978, pp 24-25.

Santa Fe Overseas, Inc., recently completed a 4-berth sea island 1 mi offshore at Ras Al Mish'Ab on Saudi Arabia's Gulf Coast and a causeway connecting it to the mainland. By dredging a channel approach and a turning basin, Santa Fe was able to build the island a mile closer to shore than the Army Corps of Engineers originally planned, saving at least an estimated $40 million and reducing construction time.

A0174 Development and Maintenance Dredging on Rivers, The Hague, Nedeco, The Netherlands, Apr 1965.

Book gives a brief, but complete survey of dredging problems on rivers. A clear view is given of sediment movement along the river bed. Dredging practice is discussed, followed by a treatment of dredging equipment, organization of dredging, and economics.

A0175 "Development of Nuclear Measurement Techniques in the Undersea Mining of Mineral Raw Materials," Meerestechnik, Vol 7, No. 5, Oct 1976, pp 149-151.

Several systems involving use of radioactive measuring systems for determining the concentration of useful metals in deposits from the seabed are described. They involve the use of gamma irradiation from a suitable source (e.g. Cd 109), and detection of the secondary radiation by means of a scintillation counter, with analysis by a computer giving content of a range of heavy metals such as tin, zirconium, and titanium from bottom sediments. Principle of neutron activation analysis has also been applied to the assessment of manganese nodules, and a modified method devised for 'on site' measurement of the manganese/iron ratio, from which an estimate of the nickel or copper content can be obtained.

A0176 "Diamond Dredger Reaps Inshore Harvest," South African Shipping News and Fishing Industry Review, Vol 34, No. 2, Feb 1979, p 11.

The 99 GT side trawler, Urania, joined the growing fleet of small boats using diver-guided suction systems to lift diamond-bearing gravel from gullies in reefs in South Africa's inshore waters. Larger diamond dredgers separate diamonds from dredged spoil with on-board jigs. Divers take the nozzle of a suction hose to the bottom to suck up the gravel. The Urania has 2 electric centrifugal pumps which deliver 300 m^3/hr of gravel/water mixture.

A0177 "Disc-Bottom Cutterhead Reduces Spill Losses," Ocean Industry, Vol 14, No. 4, Apr 1979, p 298.

Article describes a new cutterhead designed by Breebot B.V., Dordrecht. It consists of a number of cutting blades mounted between a lower plate and an upper ring, and is claimed to be able to increase dredging production by 16-41% over crown-type cutterheads.

A0178 "Distinctive Ships," Marine Engineering/Log, Vol 82, No. 13, 1977, pp 39-91.

Notable vessels completed during 1977 are presented. They include the cutter suction dredger Langeland and the split-hull hopper dredge Manhattan Island built by Southern Shipbuilding.

A0179 "Diver Operated Dredge for Cleaning Underwater Structures," Dock and Harbour Authority, Vol 58, No. 685, 1977, p 346.

Unusual diver operated dredging system has been developed by Alluvial Mining, of Basildon, Essex, UK, to remove silt and granular material from sea bed structures Designed to operate at depths down to 152 m, dredge was constructed in three working days. Design consists of an AM 152-mm dredge head, fed with compressed air from the surface vessel through a 76-mm line. A flexible connection between dredge and foot allows unit to be easily maneuvered and directed by the diver. Complete unit will remove up to 30 t of free running sand or silt per hour or about 20 t of compacted materials.

A0180 "Diver-Operated Dredging Unit," Ocean Industry, Vol 14, No. 6, Jun 1979, p 75.

Jet pump dredging unit from Alluvial Mining Company, Ltd., having 2 separate suction pipes on the same unit for work simultaneously by 2 divers is described. It was recently successfully used in 600 ft of water in the North Sea to remove silt from a pipe line trench prior to replacement of a damaged pipe section. Unit also includes a hose handling system to aid divers and help to prevent overexertion. The system containing a submersible, 3-stage, electrically driven water pump with two 6-in. suction ports for particles <=5.5 inches in diameter is illustrated and discussed.

A0181 "Dredges in Iraq Deepening Irrigation Canals to Solve Soil Salinity Problems," World Dredging and Marine Construction, Vol 15, No. 8, Aug 1979, p 6.

Thirteen catamaran cutter suction dredgers supplied by O & K are being used to widen and deepen existing canals and a fourteenth is deployed on the Tigris River near Baghdad. Project will provide over 156 km of improved drainage canal system, and more than 3,000 km^2 of land will be reclaimed.

A0182 "Dredging," Proceedings, Institution of Civil Engineers, London, England, 1967.

Following sessions are described: Session A - History of dredging, dredging and the consulting engineer, and economics; Session B - dredging and siltation cause and effect, behavior of siltation at two British dredging sites, and use of tracers to determine infiltration rates; Session C - dredging in the River Tees (UK), recent (1968) research developments in hydraulic dredging - jet pumps, hydraulic transport, centrifugal pump design and performance, and measurement and control of output; Session D - reclamation dredging and instrumentation, automation of hydrographic operations and precise positioning. Sessions A, B, and C only highlight topics, whereas Session D provides greater detail.

A0183 "Dredging and Pipelaying-San Francisco Bay Mud Makes Way for Outfall Pipeline," World Dredging and Marine Construction, Vol 15, No. 6, Jun 1979, pp 9-11.

Equipment and methods used for the 7-mi outfall pipeline under construction for the East Bay Dischargers Authority are described. Equipment includes bucket dredge Paul Bunyan with a Manitowac 4500 dredging crane and the dredge Seminole with a Manitowac 3000 crawler with bucket and Manitowac 4500 whirly crane for handling the pipe sections. Project includes 1,569 pipe sections each of length 24 ft; inside diameter, 8 ft; outside diameter, 9.5 ft; and dry wt, 39 tons.

A0184 "Dredging Device," British Patent No. 1423812, Feb 1976.

Dredging device described consists of digging buckets fixed to the circumference of a wheel, and so mounted that they discharge inwards into a conveying device passing through the center of the wheel. Device is characterised by the hood which surrounds the greater part of the digging wheel and which has jet-nozzles for directing jets of water into the buckets.

A0185 "Dredging/Dragage," The Hague, IADC, Netherlands, 1970.

World-wide view of the dredging industry is given along with 29 photographs.

A0186 "Dredging Port Development Future Predictions Mixed," World Dredging and Marine Construction, Vol 12, No. 1, Jan 1976, pp 14-15.

Comments by port officials and dredging experts on the dredging industry growth potential, technological changes and changes in port development are given and reviewed.

A0187 "Dredging Port Development, North Africa, Middle East," World Dredging and Marine Construction, Vol 12, No. 1, Jan 1976, p 27.

Article outlines planned dredging projects in Abu Dhabi, Egypt, Iran, Iraq and Yemen.

A0188 "Dredging Port Development, North America, Pacific Ocean," World Dredging and Marine Construction, Vol 12, No. 1, Jan 1976, pp 16-23.

Article outlines planned dredging projects in North America, Canada, Hawaii and Mexico.

A0189 "Dredging Research," Hydro Delft, No. 39, Jun 1975, pp 1-10.

Activities and research carried out at the Delft Hydraulics Laboratory on behalf of the Combination Dredging Research, cutting of soil under water, two recent facilities (cutting rig, cutter suction and trailing suction flume), erosion by moving water jets, dredging of rock, and suction of sand are all covered.

A0190 "Dredging Wheel Developed by Dutch," Dock and Harbour Authority, Vol 60, No. 705, Aug 1979, pp 130-131.

Article describes a dredging wheel principle in which a number of cutting edges are placed around the circumference. It has been developed by IHC Holland.

A0191 "Dredging with a Difference - The Pneuma System," International Dredging and Port Construction, Series II, Vol 2, No. 13, Aug 1975, pp 4-5.

Description of the working principle and applications of the Pneuma dredge-pump system, operating with compressed air is given.

A0192 "East German Study of the Dredger/Barge System," International Dredging and Port Construction, Vol 4, No. 3, Jan 1977, pp 16-17.

A procedure is presented to obtain the optimum coordination of dredging and transport equipment given the site conditions and available equipment. Model considers delay time due to transfer of material, relative efficiencies of equipment and usage costs of each.

A0193 "East Pakistan River Survey Navigation Dredgers. A Feasibility Study," The Hague, Netherlands Engineering Consultants, Apr 1964.

Full-scale investigation is performed of the technical means to serve inland navigation interests of East Pakistan, based on environmental conditions such as tides, hydrographical and hydrological characteristics, soil consistency, etc., in various waterways.

A0194 "Excavator is Converted to a Dredge," World Construction, Vol 28, No. 1, Jan 1975, p 58.

Contractor took a new crawler excavator, substituted a 0.57 cu m clamshell for the backhoe bucket, and mounted entire unit on a platform in a steel barge. Conversion from land to sea operation required two weeks, but machine could be converted for shore duty within 24 hours.

A0195 "Fleet Rotation and Scientific Evaluation Assure Economic Maintenance of British Ports," World Dredging and Marine Construction, Vol 14, No. 10, Oct 1978, pp 16-18.

Maintenance dredging requirements of the British Transport Docks Board (BTDB) for south ports, east coast ports, and northwest ports are discussed. Several cases are reviewed.

A0196 "Floating Excavator Digs Deep to Mine Gravel," Rock Production, Vol 81, No. 9, Sep 1978, pp 104-106.

Raw material to feed a sand and gravel plant is mined from depths as great as 85 ft near Winnipeg, Manitoba, Canada. Mounted on a floating plant, two 7-3/4-cu yd buckets are currently digging at a 60-ft depth with an 80-sec cycle time between bucket loads. In addition to high production capacity, other considerations calling for the use of a floating plant included use of a mining method that would neither contaminate ground water nor lower the water table.

A0197 "How a Dutch Dredger Works on One Engine Instead of Two," Dredging and Port Construction, Vol 6, No. 14, 1979, pp 15-17.

Dredging operations in a new port under construction to the east of Flushing in The Netherlands were recently successfully completed, due partly to the decision to employ a single GM Electro-Motive Division Model 645, 16-cylinder turbo-charged marine diesel engine in the cutter suction dredger, 'Merwede.' The incorporation of this engine into the IHC Beaver 4000 demountable dredger created, at a relatively low cost, a more powerful, highly reliable craft which has proved to require less maintenance and down-time than one fitted with the two standard engines. While the cutter drive power remained the same, at 750 hp in both models, pump drive power in the modified version rose from 2,200 to 3,000 hp, while the total machinery output was increased from 3,450 to 4,100 hp.

A0198 "How to Buy a Quality Dredge to Increase Your Profits," World Construction, Vol 33, No. 4, Apr 1980, pp 94-95.

Given the right conditions, a cutter suction dredger is the most economical method of moving solid materials immersed in water. Article describes many differences between cutter suction dredgers, explains features to be looked for and suggests questions which should be asked before a dredge is purchased.

A0199 "IB 901 on Aruba," Ports and Dredging Oil Report, No. 87, 1975, pp 14-17.

The trailing-suction hopper dredgers "Alzubair" and "Almerbid" have a length of 90.00 m, a beam of 16.40 m, a draft (fully loaded) of 6.10 m and are powered by two diesel engines each developing 2,750 hp at 700 rpm and have a hopper capacity of 3000 cu m. Dragheads incorporate water jets to facilitate operations in compacted sand. Hoppers have neither bottom doors nor valves, since spoil dredged by these vessels is required to be delivered ashore by pipeline with the aid of dredgepumps. A hopper flushing system has been provided to solve this problem.

A0200 "Improvements in or Relating to Burying a Pipeline in a Subwater Bed," British Patent Spec. 1549681, Aug 1979.

Patent describes a method which comprises excavating a trench in a sub-water bed using a dredge, laying a pipeline in the trench, and transferring the excavated soil over the pipeline lying in a previously excavated section of the trench.

A0201 "Improvements in or Relating to Dredging Apparatus," British Patent Specification 1493360, Nov 1977.

Invention comprises a submerged pump operable by compressed air, a dredging bucket or shovel, a duct connecting the shovel to the pump cylinder for conveying of spoil, a valve in the cylinder for closing the duct outlet and a valve in the duct for effective closure of the duct when compressed air is present in the cylinder. Valve is actuated in phase with a compressed air distributor which feeds the cylinder of the submerged pump. Invention has the advantage over conventional dredging equipment in that no loss of air occurs as usually happens when the cylinder is not completely filled with dredged material and water. Invention thus attempts to remove risk of secondary pollution caused by the escape of air from the intake valve. Arrangements for double-shovel assemblies are also described.

A0202 "Improving Accuracy of Site Survey Positioning," Ocean Industry, Vol 14, No. 4, Apr 1979, pp 180 and 182.

New offshore positioning system named OASIS (Offshore Acoustic/Satellite Integrated System), developed by Decca Survey, Ltd., enables a net of acoustic transponders to be laid and accurately calibrated on a geodesic datum by using satellite signals. Decca claims that positioning within the net is accurate to ±3 m. System comprises a mini-computer which integrates acoustic and satellite positioning systems.

A0203 "Indian Firm Serves Capital and Maintenance Dredging Needs," World Dredging and Marine Construction, Vol 15, No. 6, Oct 1979, pp 6-10.

Article describes the Dredging Corporation of India, Ltd., which is a government owned company in charge of India's harbor maintenance. Projects and equipment used are discussed.

A0204 "Inland Dredging for Earthmoving," International Construction, Vol 13, No. 5, May 1974, pp 47-53.

Comparative merits of hydraulic excavators, bucket wheel excavators, and dredges are outlined. Report is mainly concerned with the novel use of the dredge "Inland" for earthmoving operations on motorway or road construction sites.

A0205 "International Harbour Congress, 6th, 1974," Proceedings, Sixth International Harbour Congress, Antwerp, Belgium, 1974.

Papers cover hydraulic engineering in harbors and offshore. Some of the specific topics discussed are as follows: offshore rock island construction; transient considerations in harbor dredging; and economic and other design considerations for a large diameter pipeline. Papers are indexed separately, and are multilingual with English abstracts in most cases.

A0206 "International Report: Belgium," Ocean Industry, Vol 13, No. 4, Apr 1978, pp 163-164.

Recent developments briefly discussed include a trailing hopper suction dredger under construction.

A0207 "International Report. South Africa, Fluidization Sled, 50-m, Buries Pipe Line to 3-m Depth," Ocean Industry, Vol 14, No. 4, Apr 1979, pp 437-438.

Article describes the design, fabrication and burial of a 1,365-m-long sewer outfall off Camps Bay near Capetown. Laying of the line was completed during the first working season, but burial to a depth of 3 m was a greater problem than anticipated. Eventually, a pipe burying machine that worked in the surf zone as well as in deeper waters was designed. The fluidization sled has frame towers at either end of the unit which support pressurized air and water system. Hose bundles, one for each tower, are over 140 m long to allow machine to move through the surf zone while the barge remains offshore. Buoyancy tanks allow the height of the sled above the sea bed and along its length to be varied.

A0208 "International Workshop on Ocean Instrumentation: Proceedings," IEEE Journal of Oceanic Engineering, Vol 3, No. 4, Oct 1978, pp 81-209.

Workshop was organized to support development of improved standards and instrumentation for the international ocean engineering community, to encourage international intercalibration, and to enhance international information exchange. The following engineering aspects and activities were addressed: coastal and offshore structures, the ocean floor, urban and industrial waste disposal, and mining and dredging.

Instrumentation needs and problems related to these activities were described.

A0209 "J. F. Craig-Grab/Suction Hopper Dredger for South African Account," Holland Shipbuilding, Vol 21, No. 1, Mar 1972, pp 46-48.

The 1,140 t grab/suction hopper dredger J. F. Craig has a length on of 53.78 m, a beam of 11.58 m, and a speed of 12 knots. Hopper capacity is 433 cu m. Article describes dredge.

A0210 "Jurong Shipyard Built Tin Dredger Arrives on Site," Holland Shipbuilding, Vol 28, No. 9, Nov 1979, p 38.

World's largest offshore tin bucket dredger, 'Bima,' is designed for 24-hr dredging and concentrating of tin ore. Each bucket has a capacity of 850 t, and the dredging capacity is 1,836 m^3/hr. Craft is sufficiently stable to ride the heaviest storms, and a hydraulic buffering system has been installed in order to protect the bucket ladder during operations in rough weather. Other particulars are also given.

A0211 "Karachi Access Channel to be Deepened," Dredging and Port Construction, Vol 6, No. 10, Aug 1979, p 6.

Article describes deepening of the harbor access channel from 30 ft to 40 ft which is one of the three major works under the fourth development program of the Karachi Port Trust.

A0212 "Land Link Will Double Port's Capacity," Dock and Harbour Authority, Vol 60, No. 705, Aug 1979, pp 131.

Dredging along the south side of Lummus Island, port of Miami, to connect its ship channel to the south side of Dodge Island. Dredged material will be deposited between the two islands giving the required land link.

A0213 "Large Project in Mobile Bay," Dredging and Port Construction, Vol 7, No. 2, Feb 1980, pp 7 and 9.

A new navigation channel and turning basin are under construction at the Theodore Industrial Park, Mobile, U.S.A., by the C. F. Bean Corp. Thirty-one m yd^3 of material will be removed over a period of 30 months. A combination of two bucket dredgers, two barges and two tugboats are being used at first, to conserve fuel and to experiment with the subsidence of the bottom of the bay; three suction dredgers (the 'Dave Blackburn,' 'Jim Bean' and 'Buster Bean') will later be used. Spoil from the project will be used to construct three ring levees, each about 10,000 ft long, which will enclose a spoil island covering 1,100 acres in Mobile Bay. Material will be displaced to the island by a 38,000-ft-long pipeline, operating at a pressure of up to 300 lb/in^2.

A0214 "Lasers Used for Dredge Positioning," World Dredging and Marine Construction, Vol 14, No. 3, Mar 1978, p 39.

Use of laser positioning systems in dredging, rock dumping and pile driving operations is briefly outlined.

A0215 "Little but Good," Civil Engineering, (London), Vol 70, No. 830, Nov 1975, p 29.

Article describes the use of a small dredger, the Mudcat, in places inaccessible to large dredgers, e.g. industrial lagoons. Machine excavates, carts, spreads and levels in one continuous process, thus competing very favorably with more traditional earthmoving methods.

A0216 "Loading Calculators Increase Hopper Dredging Efficiency," World Dredging and Marine Construction, Vol 10, No. 13, Nov 1974, pp 39-40.

Operating at maximum cost efficiency is possible if the ratio of the vessel's loading state to the time required for the subsequent journey to the disposal site has an optimum value. Article briefly discusses a special electronic calculator located on board ship to obtain this value.

A0217 "Making the Suez Canal Wider and Deeper," World Construction, Vol 32, No. 8, Aug 1979, pp 31-33.

The Suez Canal has been adapted to meet shipping needs over the years since its completion more than a century ago. The biggest reconstruction ever is at present being carried out. Article describes the alterations which are being done in two phases, and discusses contracts, construction, dredging, cost, etc., of this large enterprise.

A0218 "Massive Dredgers Make Artifical Islands Top Production Option," Offshore Engineering, Dec 1979, pp 49-50.

The three main options for the type of fixed platform to be used in Dome's first commercial field in the Beaufort Sea are: artificial earth fill islands for the shallowest water; large gravity caissons in the middle depth range; and the 'monocone' in the deepest water. The first is the simplest option, and the planned development of trailing suction hopper dredgers of more than three times the 6,000 m^3 capacity of current vessels could make such islands viable to 60 m.

A0219 "Method and Means for Excavating an Underwater Trench," British Patent No. 1316481, May 1973.

Apparatus is particularly suitable where the trench is to be made in sand, clay or silt, and the trench is to carry pipes or electricity cable. A towing line and a bundle of pipes including pressurised water pipes as well as pneumatic pipes are connected between a work boat and the excavating device. Device includes a saddle through which the pipe to be buried slides. Nozzles connected to the saddle supply water in downward jets onto the bed to break up the bed. Water and loose material is sucked into suction tubes and out the top. Volume flow rate of water delivered to the jets is less than 85% of the volume flow rate of air delivered to the suction tubes, while the water pressure is more than 5 Kg/cm^2. Broken-up sea bed material is not lifted up to the work boat but is laid uniformly at both sides of the trench and can easily be raked over the pipe.

A0220 "Minimising Dredge Crane Grab Repairs," Dredging and Port Construction, Vol 6, No. 14, Dec 1979, pp 8-9.

Article discusses cost of crane grabs and average cost of repairing them. It is concluded that the comparatively small cost of regularly maintaining and refurbishing grabs used on dredging duties must be regarded as an essential and inexpensive form of insurance, with the current high price of grabs, and with the tendency of law courts to award very high damages.

A0221 "Mobile Platform Can Dredge, Drive Piling, Lay Pipe," World Dredging and Marine Construction, Vol 15, No. 5, May 1979, p 42.

A mobile marine platform called the "Spider," can achieve motion in any horizontal direction, through hydraulically lifting up and forward a set of legs while another set remains firmly on the ground, in a step-wise fashion. Platform eliminates the erection of temporary work platforms and replaces unstable derrick barges for marine construction in shallow water.

A0222 "Motorola Develops Systems for Remote Survey, Positioning," Sea Technology, Vol 21, No. 3, Mar 1980, pp 33-34.

The Porta-Ranger remote survey/positioning system, recently introduced by Motorola's Government Electronics Division is a tracking system with a data link that employs the Mini-Ranger III system and a new mobile reference station with operator interface. The latter enables the system to have applications as a small boat system for shallow-water hydrographic or oceanographic surveys, a harbor entry and ship control system and a single-point mooring control system.

A0223 "Navigation Dredgers. A Feasibility Study," East-Pakistan River Survey, The Hague, Nedeco, Apr 1964.

For the development of the natural waterways of East Pakistan, a study has been made on the dredging feasibility: navigation routes; fleet; system of dumping spoil; program of requirements; selection of equipment; and sizes and capacities. Recommendations on economics, management, specifications, etc., are given. Comments by the Director of the dredger organization are given, with a summary and conclusions.

A0224 "Need for a Clear-Cut Government Policy on Dredging for Aggregates," Hydrospace 2, No. 3, Sep 1969, pp 50-52.

Status of the marine aggregate industry in the U. K., is examined, and the reasons why dredging operations will tend to take place further offshore, and in deeper water are also covered. In view of the growing importance of sea-dredged aggregates to British industry, there is a need for solid backing from Government in terms of licensing, financing and forward planning, particularly in the field of dredging equipment where there are some urgent requirements.

A0225 "New Compact Dredger from Dredge Masters," Dredging and Port Construction, Vol 7, No. 1, Jan 1980, p 5.

Dredge Masters International, Inc., has developed the 'Mud Master,' in which an unprecedented ladder/main frame concept is claimed to constitute a significant breakthrough in dredger design. This enables ladder depth to be extended and provides greater stability. Most important feature of the craft is described as the interchangeability of various dredging components to satisfy a broad range of dredging applications.

A0226 "New Dredging Generation," Consulting Engineer (London), Vol 42, No. 10, Oct 1978, pp 59-64.

Advances in dredging technology are discussed and introduction of the M Steven 80 cutter suction dredger which is reported to give a new dimension to a dredger's ability to work in exposed conditions, hard soil types and at high production rates is presented.

A0227 "New Dredging Machine from Alluvial Mining," Dredging and Port Construction, Vol 7, No. 3, Mar 1980, p 5.

Article briefly outlines a suction dredging machine which is available in remote control or diver-operated versions and can be used for a wide range of tasks including dredging pipeline trenches to 3-m depths, silt clearance, and mineral recovery (especially of diamondiferous gravels). When the machine is diver-operated, flexible suction hoses of up to 30 m in length are employed. Various discharge configurations are available.

A0228 "New Rock Trencher Tests Its Teeth," Offshore Services, Vol 12, No. 11, Dec 1979, pp 30 and 32.

Land and Marine Engineering was contracted to develop a rock trenching system to cut a path for a proposed 250 V DC cross-Channel cable link between England and France. Known as the RTM II, the prototype rock trenching machine is a remote-controlled, self-propelled, sea bed vehicle of variable buoyancy, fitted with a drum type cutter system. It has been designed to operate with a cable-laying sled, and has been equipped with a ripper-type wire laying shoe which will position a steel hawser in the trench so that the cable sled can haul itself along. Sea trails of the prototype are nearing completion.

A0229 "New Sea Floor Mapping System," PetroMin Asia, Jul 1979, p 28.

EG&G's SMS960 Sea Floor Mapping System has two primary advantages over side scan sonar systems previously available to industry. First, distortion inherent in the graphic presentation on all existing commercial side scan recorders is corrected by digital processing. Secondly, the SMS960 may be interfaced with a precision navigation system to correct variations in ship's speed and to produce a relatively accurately positioned track line strip chart which may be assembled with other track line charts to produce a mosaic map of the sea bed.

A0230 "New Suction-Side Seal for Dredge Pumps," Holland Shipbuilding, Vol 29, No. 3, May 1980, pp 45-46.

A dredge pump traditionally has a seal on the shaft side. Existing IHC suction-side seal is described, and the reasons for reduction in its useful life as the pressure differential in the pump increases are given. A new design, the threaded bush seal, was developed, in which pressure of the medium is reduced by means of a quantified technical leakage.

A0231 "New Vessels," Holland Shipbuilding, Vol 26, No. 8, Oct 1977, pp 106-108.

New vessels discussed include the cutter suction dredger "Gironde," which features hydraulic spudhoisting equipment; the Jebel Ali Bay and the Jumeira Bay, 2 of 4 cutter suction dredgers built by IHC Holland; the Thames, a split hopper trailing dredger; Prins van Wijngaarden, one of the smallest vessels in the IHC split trail series; and the floating excavator Hippopotes, one of the biggest ever built in the Netherlands.

A0232 "NI-Hard Repairs......Out of a Suitcase," Dredging and Port Construction, Vol 7, No. 5, May 1980, p 6.

A recent development by Kramtechniek Internationale, The Netherlands, has resulted in the material NI-HARD being able to be repaired without the use of welding. This short article gives some details of the procedure using a formula for a mixture of heat- and rust-resistant

materials. Important feature of this technique for dredging contractors is its cost-effectiveness for the repair of dredge pumps.

A0233 "Ninth Annual Directory of World's Dredges and Their Owners," World Dredging and Marine Construction, Vol 11, No. 2, Jan 1975, pp 6-52.

World's dredges and addresses of their owners are listed.

A0234 "Novel Dredge Offers Rapid Cut and Bury Underwater," Offshore Services, Vol 10, No. 7, Jul 1977, pp 22, 23 and 28.

A flexible suction dredge system for underwater trenching and burying of pipelines and cables is described. System can either be used as a hand-held device or as a deepwater dredge operated by a submersible craft. Dredge, when mounted on a wheeled frame, becomes self propelling. Cutting jets are used to break down the working face of the trench. Details of the dredge arrangement are given together with some examples of successful operations already completed.

A0235 "O & K Dredging," Construction News Magazine, O & K Special Issue, 1976, pp 33 and 35.

Article gives a brief look at earlier forms and methods of dredging, and goes on to describe some of todays O & K equipment and their applications in this field. Equipment includes cutter suction dredges, dredge pumps, dipper dredges, and barge-mounted backhoes.

A0236 "Observator Markets Cutter Dredger Automatics Over 100 Units in Operation," Holland Shipbuilding, Vol 28, No. 8, Oct 1979, p 116.

In the past 25 years, instrument engineers of Observator B. V. have designed a comprehensive range of dredging instruments, including a cutter suction dredger automation system.

A0237 "Odd Looking Amphibian," PetroMin Asia, Sep 1979, p 54.

An amphibious dredger and excavator is described. This adaptable vehicle has legs for propulsion on water or over soft ground, and can carry out dredging or excavation work in deep water supported by its legs. Vehicle can be fitted with a wide variety of equipment, including a crane.

A0238 Offshore Technology Conference, 5th Annual, Preprints, (2 Vols), 1973.

One hundred and sixty-eight papers by various authors are presented in two volumes. Topics discussed include all aspects of offshore technology i.e., deep ocean mining; dredging; and navigation systems.

A0239 Offshore Technology Conference, 7th Annual, Proceedings, (3 Vols), 1975.

Two hundred and forty-five papers by various authors are presented. Topics discussed include dredging artificial islands and submarine pipelines.

A0240 Offshore Technology Conference, 8th Annual, Proceedings, (3 Vols), 1976.

Two hundred and fifty-five papers by various authors are presented. Topics discussed include: ship navigation systems, satellite positioning; industrial artificial islands; techniques for optimizing marine seismic data; dredging operations; pipeline laying techniques; offshore soil investigations, seismic and acoustic; and design and construction of offshore oil and bulk terminals and pipeline transport.

A0241 "'Ollie Riedel' Used at Delicate Ventura Keys Dredging Project," World Dredging and Marine Construction, Vol 15, No. 12, Dec 1979, pp 26-29.

Western Pacific Dredging Corp. obtained a contract to remove 83,000 yd^3 of material from the main channel and three artificial inlets at Ventura, California. The 'Ollie Riedel,' a 26-in. cutter suction dredger, was used for the former and a small portable cutter dredger for the even narrower fingers of the inlet. Disposal of material was at sea, through a series of settling ponds.

A0242 "Persero Dredging Capability Boosted," PetroMin Asia, Nov 1979, p 28.

Article describes details of a cutter suction dredger. Features include a spud and anchor wire system used to moor the craft and move it forward or astern; a Christmas Tree mounted on the center line at the stem; a submersible hydraulic cutter drive; and a double walled dredge pump, driven by a medium speed Caterpillar diesel engine.

A0243 "Pneuma, Environment - Compatible New Areaging Concept," Holland Shipbuilding, Vol 25, No. 6, Aug 1976, p 42.

The Pneuma system can be used for dredging a wide variety of soils, including polluted soil, as this is not mixed with the surrounding water. Pump is a solid displacement pump with compressed air acting as a piston and providing the driving force. Standard pump body has three sheet steel cylinders with convex dished ends, and works on a two stroke cycle.

A0244 "Port of Bristol: Silt-Laden Tidewaters Create Dredging Need in Impounded Dock Systems," World Dredging and Marine Construction, Vol 14, No. 9, Sep 1978, pp 60-62.

High tidal range and heavy silt content from nearby rivers prompted the Port of Bristol Harbor Authority to use a fleet of six dredges to maintain project depths in the impounded dock systems. The maintenance dredging is performed by cutter suction, bucket ladder, and grab dredges. Vessel capabilities and wear on the dredging equipment observed to date is reported.

A0245 "Positioning System for Miami Port Development," Dock and Harbour Authority, Vol 60, No. 709, Dec 1979, p 274.

Article briefly outlines the MRD 1 automated microwave positioning system developed by Tellurometer which is in use for dredging of the outer ship channel. It continuously monitors precise position of the dredger, and is also being used by the development survey team to provide fully automated pre- and post-dredging cross-section data.

A0246 "Proceedings of Dredging Day Europort 72 Congress, Amsterdam, Nov 16, 1972," Terra et Aqua, No. 3/4, 1972, pp 1-48.

Proceedings contain planning of projects, investigations for dredging projects, financing of port projects, modern dredging techniques, maintenance dredging in tidal rivers, and future developments in dredging on sea. Proceedings also contains discussions on these subjects.

A0247 "Proceedings of 2nd Dredging Day, Bordeaux, 4th Nov. 1974," Terra et Aqua, No. 8/9, 1975, pp 1-48.

Employment of trailing suction hopper dredgers in the Gironde, operations research in dredging, hydraulic engineering and the human environment, the effect of offshore and gravel mining on the marine environment, dredged Rotterdam harbor mud: its qualities and use as soil, and tracer techniques.

A0248 "Reinforced Plastics for the Dredging Industry," Holland Shipbuilding, Vol 22, No. 6, pp 440-441.

Use of reinforced plastics in the construction of dredging equipment is discussed. Advantages of using reinforced plastics for dredging purposes are given, among them light weight, high abrasion resistance, transport savings, maintenance, and properties of the plastics, such as flexibility and shock-resistance. Descriptions of the plastic ball joint and floating discharge lines are also given. Production process, with raw materials used in the construction, chemistry of the process, and method of production is discussed. Development of the process, as well as the quality control system that was established, are both briefly discussed.

A0249 "Report on the Test Dredging of the River Niger, Nigeria," The Hague, Netherlands Engineering Consultants, 1961.

A test-dredging near Bokoja has been carried out aimed at gaining necessary experience to plan dredging in the Niger on a larger scale. Considerable attention has been paid to equipment to be used and to the working method, and stability of the dredged channels during and especially after dredging has been carefully studied.

A0250 "River Humber: Harbor Maintenance Carried Out by Modernized Dredging Fleet," World Dredging and Marine Construction, Vol 14, No. 9, Sep 1978, pp 27-30.

The British Transport Docks Board designed and supervised construction of 9 modern dredges for modern harbor maintenance on the River Humber. Three ports - Grimsby and Immingham on the south bank of the estuary, and Hull further upstream on the north bank - require continuous maintenance dredging. Two 1,262-m^3 center stern well suction dredges operate in the dock entrances at Hull, supplementing their capacity with grab dredge tonnage in areas which are either inaccessible to the suction or have become consolidated beyond their capacity by a localized high sand content. The 7 grab hopper dredges in the Humber fleet range from 2 triple grab dredges with hopper capacities of 1,223 m^3 to 1 single grab dredge of 382 m^3. Inside the enclosed docks, almost all dredging is performed by grab dredges working to priority areas, while around commercial shipping, routine dredging takes place.

A0251 "San Diego Dredging Project Replenishes Beaches," World Dredging and Marine Construction, Vol 14, No. 2, Feb 1978, pp 7-8.

The Army Corps of Engineers in cooperation with the San Diego Unified Port District and the U. S. Navy contracted to dredge nearly 8 million yd^3 of sand from the harbor and turning basins at San Diego Harbor, and use material to replenish the beaches and reclaim an area for a new small boat marina. After 30 months of dredging with clamshell and hydraulic dredges, main navigation channels were lowered from 35 to 42 ft, and a new turning basin was created.

A0252 "Saudi Arabia: Joint Venture Achieving Massive Extension of Dammam Harbor," World Dredging and Marine Construction, Vol 14, No. 9, Sep 1978, pp 53-55.

In recent years, the government of Saudi Arabia has let out to contract a number of large harbor projects. One of these, the further extension of the harbor of Dammam (the West Port), was awarded in 1975. For both partners the Dammam project was the largest dredging project ever undertaken. Work to be performed included dredging of a dock basin to depths between 12 and 14 m; dredging of foundation trenches along this dock basin for quay walls; dredging of a swinging area in front of the east and west basins to a depth of 15 m; dredging of an anchoring area covering 16 million m^2, to a depth of 15 m; dredging of a 15-m-deep access channel 18,000 m long between the dock basins; utilization of the soil dredged for reclamation of 325 ha of harbor sites situated around the west basin; and building of a 6,300-m-long protective breakwater. Proposed working method provided for use of trailing hopper suction dredges and cutter suction dredges for the entire portion of the work. The whole of the basin and part of the swinging area were dredged by a cutter suction dredge, which pumped directly into the areas to be sandfilled.

A0253 "'Schelde II', Trailing Suction Hopper Dredger for Dredging International Belgium," Holland Shipbuilding, Vol 28, No. 4, Jun 1979, pp 42-46.

'Schelde II' has a total output of 8,460 hp and a hopper capacity of 3,200 m^3. IHC Smit supplied the suction pipe (internal diameter 900 mm), and the maximum dredging depth is 29 m. Dredgepump is of the double-walled type. Details on dredging instrumentation are also given.

A0254 "Second International Symposium on Dredging Technology," BHRA Fluid Engineering, 1977.

Summaries of papers presented at the symposium are given. Topics discussed include international dredging contract conditions; hydrodynamic and geometric parameters of shells as dredge material; fine sediment studies relevant to dredging practice and control; maintenance and

regulation of navigable channels by submerged contractions; influence of cutterhead height on dredge production; electronic 3-D-positioning of the dredge head improves economy of bucket-and-cutter dredge operations; the new generation of dragheads for the hopper dredge; technological gaps and environmental effects of marine mining; trenching in granular soils; and others.

A0255 "Sedimentation Meter," Ports & Dredging (IHC), No. 103, 1979, pp 4-6.

Description of a sedimentation meter, used for the purpose of soil investigation prior to dredging, is given. Theoretical aspects are also presented.

A0256 "Selecting the Proper Pump Motor, Part I," Water and Sewage Works, Vol 125, No. 11, Nov 1978, pp 60-63.

More than 90 percent of the electric motors in the water utilities industry are alternating-current, squirrel-cage induction types. These motors are available in all sizes and types of mountings with various enclosures. Such motors are generally used for constant speed applications. Operator should be knowledgeable about picking appropriate motor and peripheral gear.

A0257 "Self Elevating Heavy Duty Offshore Cutter Suction Dredger," Meerestechnik Marine Technology, Vol 10, No. 5, Oct 1979, pp 165-166.

The design and construction of the dredger 'Al Wassl Bay' resulted from meeting design criteria dictated by difficulties of excavating an approach channel for the new port Mina Jebel Ali near Dubai. Design criteria included a minimum cutter horsepower of 2,000; capability to operate in adverse weather conditions (wave heights up to 4.5 m and wind velocities of up to 65 km/hr); and disposal of the spoil using barges. Dredger consists of two pontoons connected by two box girders. It can 'walk' either forward or backward using all four pairs of legs. Cutter is driven by two electric motors (total diesel horsepower 3,000), and the dredge pump has a capacity of 11,000 m^3/hr through a suction pipe with a diameter of 800 mm and a 750-mm discharge. Other particulars are also given.

A0258 "Small Automatic Profiling Tractor," Ocean Industry, Vol 14, No. 7, Jul 1979, p 83.

The tractor, developed at Scripps Institute of Oceanography, is designed to provide a profile of beach and sea bed conditions. It is electrically driven and is remotely controlled from shore. Craft will be used at Del Mar, California, to evaluate causes of beach erosion during winter storms.

A0259 "Small Dredge Adapted to Mine Rock for Cement Plant," Engineering News Record, Vol 196, No. 5, Jan 1976, p 24.

A modified portable dredge is successfully dredging hard compacted marl and limestone. Modifications have enabled the 12-inch unit to cope with four times more material than it was designed to pump. Dredge is fitted with a rapidly turning cutting device mounted next to the dredge's suction head. Device mills or shaves the compacted material. Dredge also employs a 'Wagger' system designed to eliminate the need for anchors and cables and to save repositioning time. System allows unit to move forward and to swing through a 180-degree arc.

A0260 "Softer Soil Means Cheaper Dredging at Ramsgate," Dock and Harbour Authority, Vol 60, No. 705, Aug 1979, p 130.

A pre-tender survey recently completed by Alluvial Mining, U. K., using a Dutch rock corer, "the Prikkenbeen," and a 6-m vibrocorer has shown that the material to be dredged from the harbor approach channel at the proposed new West Rocks ro/ro ferry terminal is much softer than previously believed.

A0261 "South Coast Shipping Takes Delivery of the Suction Dredger Sand Skua," Motor Ship, Vol 52, No. 613, Aug 1971, pp 232-233.

The 1168 gross ton trailing arm suction dredge, "Sand Skua," has a length of 67.17 m, a beam of 12.20 m, and a draft of 4.42 m. Dredge will be employed in dredging for aggregates and is equipped with an onboard grading system.

A0262 "Space Age Dredger," Dock and Harbour Authority, Vol 61, No. 719, Oct 1980, p 199.

A color display controller showing both profile of the sea bed as it is being dredged, as well as exact position of the cutterhead itself, is a feature of the computer system installed on the 'Simon Stevin,' the massive semisubmersible cutter suction dredger.

A0263 "Standard Dredgers: New Development by Dutch Shipbuilders," Shipping World and Shipbuilder, Dec 1967.

A series of standard dredgers of varying types has been developed by IHC Holland, shipbuilders and engineers of Rotterdam. This has been done with a view to lowering investment, offering a quicker delivery and providing a simpler spares service. New developments include trailing-suction hopper dredgers, cutter-suction dredgers and bucket dredgers. Article describes the standard trailing dredger.

A0264 "Study of the Problems of Dredging and the Floating Dredges in the United States of Mexico," Marine Secretary, 1961.

Paper defines dredging problems within a total of 25 harbors and canals in Mexico. Text is in Spanish.

A0265 "Stulbia," Holland Shipbuilding, Vol 27, No. 12, Feb 1979, p 44.

The 325-1 bucket dredger "Stulbia," built by IHC Holland and delivered to the Polish sea-dredging enterprise P.R.C.I.P. is described. Propulsion and principal particulars are included. Dredger will be used for maintenance work.

A0266 "Subsea Line Buried Using Advanced Technique," Oil and Gas Journal, Vol 73, No. 5, Feb 1975, pp 88, 90.

Sub Sea Oil Services is using a new machine to bury pipeline coming ashore. A self-propelled, pipe burying machine, it walks along the pipeline by push-pull application of hydraulic clamps. All controls are operated from the mother ship at the surface.

A0267 "Suction Cutterhead Dredges Aid in Mining Operations," World Dredging and Marine Construction, Vol 10, No. 5, Apr 1974, pp 30-31.

Case studies describing use of custom-built hydraulic pipeline cutterhead dredges in mining and aggregate operations are presented. It is reported how production problems in an alluvial tin mining operation in France were solved through use of a hydraulic pipeline cutterhead dredge.

A0268 "Suction Dredger," British Patent No. 1449843, Sep 1976.

Specification describes a trailing cutter suction dredger in which the boom carrying the suction pipe and cutter wheel slopes upwards in the direction in which the dredger is moving. For greater stability, the pontoon or hull of the dredger can be in form of a catamaran. This arrangement makes the dredger suitable for operations at greater depths than the 'conventional' dredger, in which the boom slopes downwards in the direction of travel, but this system can also be operated in the reverse direction.

A0269 "Suction Dredger," British Patent No. 1552921, Sep 1979.

Invention provides greater reliability in operation of the connection between the water tube flange and the water duct flange. Suction dredger is characterized by the slush tube being supported by means of the rotary gland for swivelling movement with respect to the flange which is rigidly connected to the floating body.

A0270 "Suction Head Positioning System Developed to Increase Dredging Efficiency," World Dredging and Marine Construction, Vol 15, No. 9, Sep 1979, pp 36-37.

Helle Engineering, Inc., San Diego, has recently introduced a new Trailing Suction Head Location System, which is designed to monitor the position of two suction heads simultaneously and consists of an interrogator, a pre-programmed HP 9815A computer, two remote display units, two hydrophones and two transponders. Only one transponder and one remote display unit are used for single suction head operation. Position of

the head in relation to any given reference point is displayed with accuracies of 1 m fore and aft, 1.5 m athwartships, and 0.3 m in depth.

A0271 "Supplementary Sand for Beaches," Land and Water International, Vol 36, 1977, p 15.

Article describes use of dredges to nourish beaches in the Netherlands.

A0272 "Thames - The First IHC Splittrail," Ports, Dredging and Oil Report, No. 95, 1977, pp 4-6.

"The Thames" is especially well suited to dealing with sticky materials such as clay, clay loam and silt. Hopper shape enables these materials to be discharged with ease. A salient feature of the vessel, which can dredge to a depth of 20 meters, is an IHC Integral Suction System, comprising an underwater pump and driving motor, which is situated approximately midway along the suction pipe. This underwater pump enables mixture with a very high solids concentration to be dredged - a factor of particular importance when working in silt. Output can be increased by 150% by use of this type of pump.

A0273 "The Dredging of Rock," Hydro Delft, Vol 39, Jun 1975, pp 7-8.

Factors governing the mode of dredging employed for removal of solid rock are discussed. Laboratory tests for cutter suction dredging have enabled the Delft Hydraulics Laboratory to construct a mathematical model for predicting cutting forces, involving uni-axial compression strength, tensile strength, and indirect tensile strengths (Brazilian test) of the rock encountered. Alternative technique of drill-blasting is also considered.

A0274 "The Dutch Experience," Civil Engineering, Oct 1979, pp 41 and 43.

Article describes four areas of land reclamation research that the Dutch have concentrated upon, including drilling and blasting techniques, and handling of harder materials. They are also developing a new generation of more powerful dredging equipment such as the 'Simon Stevin,' a semi-submersible, self-elevating cutter suction dredger. This dredger can operate in anything but the most severe swell conditions, and on previously inaccessible stretches of coastline. Platform-style solves some typical problems of cutter dredging. Work being carried out on major land reclamation projects is also described.

A0275 "The IHC Automatic Bucket Dredger Controller," Ports and Dredging (IHC), No. 103, 1979, pp 17-19.

Development of the controller, the first of which is now installed in a large tin ore dredger, the 'Bima,' is described. Basic functions of the system, which employs a microprocessor, are: to swing the dredger to port or starboard; to regulate the braking torque of side winches which are in the paying-out mode; to control dredging angle; and to control ladder winch and the head winch. Controller purpose is to obtain continuous, maximum production by full utilization of available power.

A0276 "The Micro in Dredging," Consulting Engineer, Vol 44, No. 5, May 1980, pp 10-11.

An automatic control system developed for bucket dredgers by IHC is described. System has been installed in a large tin ore bucket-dredger, the 'Bima.' Central processing unit in the controller consists of a microprocessor and the required method of operation is fed in the form of a program. Some details of the controller and its method of operation are given. Basic functions of the controller are to swing the dredger to port or starboard, to regulate braking torque of the side winches, and to control ladder winch and the head winch.

A0277 "The Theory of Hydraulic Transport," Colliery Engineering, Vol 33, No. 392, Oct 1956, pp 423-429.

Continuing the theory connected with hydraulic transportation of solids as could be used in mining, a scientific correspondent discusses effect upon the pressure required of the nature of solid particles and of their concentration, and compares theories with certain test results obtained.

A0278 "Twin Screw Hopper Dredge Delivered to South Africa," World Dredging and Marine Construction, Vol 10, No. 1, Jan 1974, p 37.

A twin-screw diesel-electric hopper suction dredge is described. It has a capacity of 2,830 cubic meters, and has been delivered to the South African Railways for maintaining the seaward harbor entrances of the port of Durban. Dredge is equipped for trailing suction dredging with side suction pipe and plain suction dredging by means of a bow suction pipe.

A0279 "Two New Dredgers for Bos Kalis," Dredging and Port Construction, Vol 6, No. 10, Aug 1979, p 6.

Principal particulars of two cutter suction dredgers, the 'Vecht' 2,200 hp, and the 'Kelani Ganga' 1,500 hp are given.

A0280 "Two New Products from IHC," The Motor Ship, Vol 58, No. 687, 1977, p 124.

Two products from IHC Holland are the integral suction system - an electrically driven dredge pump fitted in the overboard pipe and an automatic suction pipe controller which automatically lowers a dredge pipe to the required depth. Article describes both products.

A0281 "Two Recent Facilities," Hydro Delft, Vol 39, Jun 1975, pp 4-5.

A pilot-scale test rig for examining processes involved in cutting through soils at different velocities and under different degrees of compaction has been in operation for some time at the Delft Hydraulics Laboratory. These facilities have now been extended by the provision of a pilot-scale cutter and trailing suction flume for the study of cutter suction dredging. This equipment is described and illustrated.

A0282 "Umm-Elzemoul/Al-Khatem/Al-Hamra: 3 Multiplied by 8,990 KW (3 Multiplied by 12,330 HP)," Ports and Dredging & Oil Report, No. 97, 1978, pp 10-12.

Three vessels, the Umm-Elzemoul, Al-Khatem and Al-Hamra, were designed and built by IHC, and display all the features of the modern cutter suction dredger, such as: an electrically driven underwater pump; two IHC double-walled dredge-pumps in the pontoon; a 20-ton-capacity revolving crane which can be moved over the entire length of the deck; a ladder gantry which forms part of the ship's structure, thus affording great strength and rigidity; a spud carriage with a 6-m stroke; anchor booms; a spud tilting installation; and extensive instrumentation.

A0283 "Update on Offshore Mining - the Unheralded Mineral Producer," Mining Engineering, Vol 27, No. 4, Apr 1975, pp 42-46.

Author discusses sand and gravel - the first offshore mining target. Tin mining is also considered, and information is given on standard-type dredges, their operating restraints, operating costs, etc. Finally, criteria for offshore drilling and blasting are suggested.

A0284 "Varied Dredging Jobs Require Self-Contained Plant," World Dredging and Marine Construction, Vol 14, No. 7, Jul 1978, pp 30-31.

Modern dredge applications often require dredge to be self-contained in terms of propulsion. This concept along with auxiliary equipment necessary for efficient operation are discussed.

A0285 "Vlaanderen XIX," Holland Shipbuilding, Vol 27, No. 6, Aug 1978, pp 52-54.

The self-propelled, fully seaworthy cutter suction dredger "Vlaanderen XIX" built by IHC Holland is of an unconventional design with stern-mounted cutter ladder and forward-mounted propellers. This design has a number of advantages: it can continue to operate to the limits of possibility; work can be resumed immediately when conditions improve; no tug or other assistance is required; and transport costs are lower.

A0286 "Walk Up Start for New Dredging Technology," Australian Mining, Vol 71, No. 9, Sep 1979, pp 16-19.

Harbors can be constructed in areas previously considered impossible with the commissioning of the "Simon Stevin," the world's first semi-submersible walking cutter dredger. Article describes dredge and possible uses.

A0287 "WGW Split Train Gear Units for Cutter Head Drives," Holland Shipbuilding, Vol 28, No. 8, Oct 1979, pp 108-110.

A considerable reduction in weight and cost is made possible by the split train gear unit. Low weight does not impair operational reliability of the gear units. Experimental measurements have demonstrated that a highly uniform load distribution can be achieved. Designs of split train gear units DURUCUT (for cutterhead drives) and DURUBLOC (for winches and similar heavy duty drives) are illustrated.

A0288 World Dredging Conference, 4th, Proceedings of WODCON, 1971.

Proceedings of the Conference, sponsored by the World Dredging Conference Assn (WODCON), World Dredging Assn (WODA) as well as Texas A&M Univ and Oregon State Univ, contains 31 papers presented under the theme: "A Salute to the Dredging and Marine Construction Industry of North America." Articles cover the Dustpan Dredge; a total concept approach to rebuilding pump shells; estimation of design data for transportation of solids in horizontal pipe lines; airlift systems for mineral recovery in ocean mining; explosives as a tool for marine construction; deep dredging by jet-ejector dredger; metallurgical quality control for dredge cutter parts; leveling equipment for rubble mounds; on-board sewage treatment systems; environmental considerations for estuarine dredging operations; and state regulation of dredging.

A0289 "Zanen Verstoep Active on a World-Wide Scale," Holland Shipbuilding, Vol 28, No. 8, Oct 1979, p 94.

Article outlines the dredging fleet of, and some of the contracts carried out by, Zanen Verstoep N.V., The Hague. In particular, use of the giant self-propelled rock cutter suction dredgers 'Aquarius' and 'Libra' in Canadian and Syrian contracts is mentioned.

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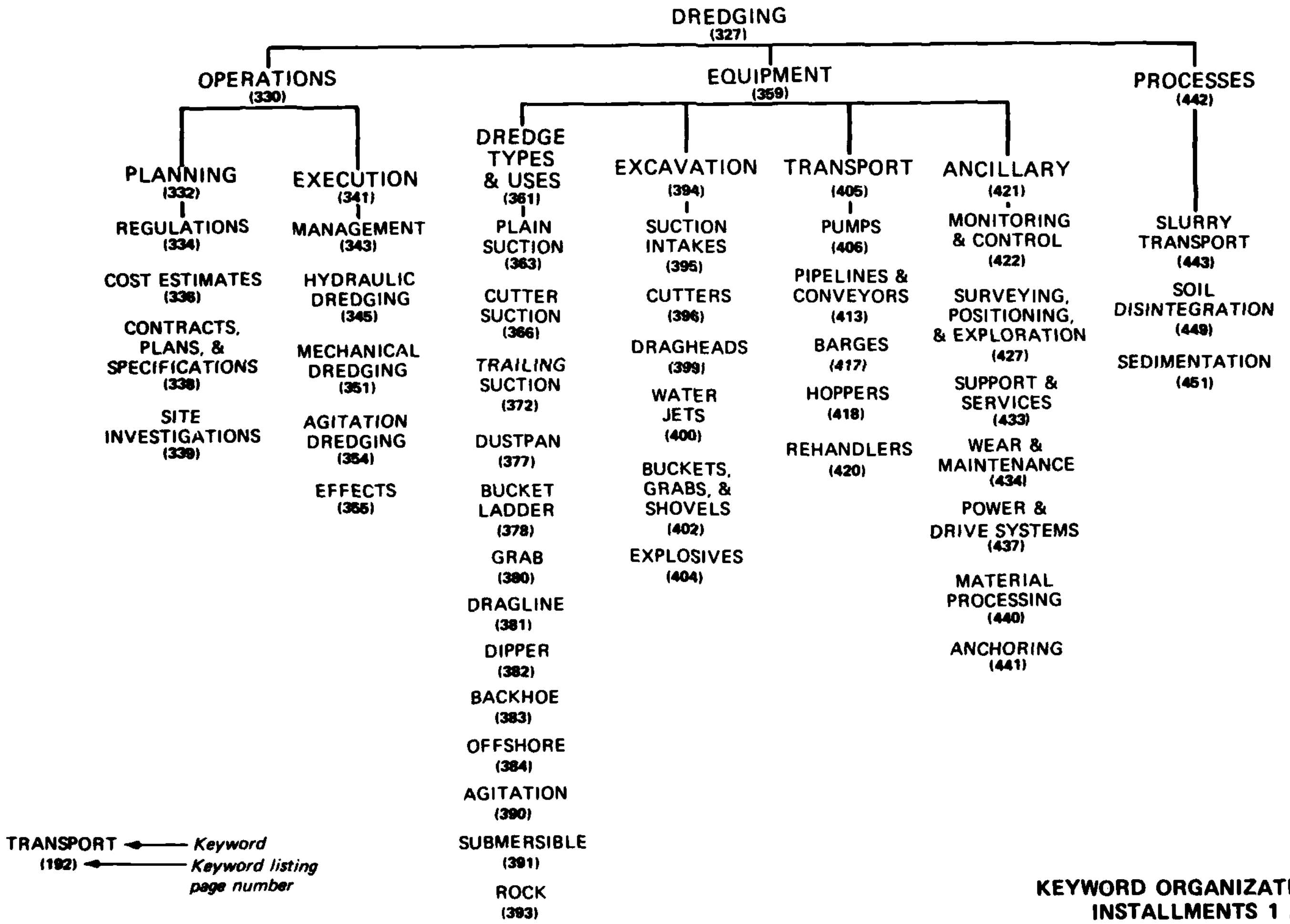

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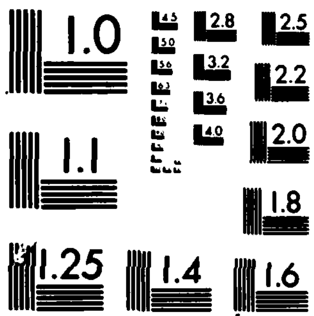

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